THE QUANTUM DECAMERON

Giancarlo Borgonovi

The Decameron, a masterpiece of classical Italian literature, is a collection of 100 novellas by Giovanni Boccaccio (1313-1375). The tales are narrated by a group of young men and women who escaped a pestilence in Florence by secluding themselves in a villa outside the city. The tales, which range from the erotic to the tragic, provide a document of life in the period between the Middle Ages and the Renaissance, and have been a source of inspiration for many authors afterwards.

Quantum Mechanics, or more generally Quantum Theory, is a branch of physics that deals with objects too small to be experienced directly. Accordingly, their laws and behavior are quite different and mostly at odds with our daily sensory experience. The quantum world is strange and funny. Quantum fluctuations in the brain are probably the prime source of the short stories in this book.

Cover illustrations:
Gentleman: Sketch from Stibbert, derived from painting by Vittore Carpaccio in the Gallery of the Accademia, Venice, Italy.
Lady: derived from a fresco by Andrea di Bonaiuto, Cappella degli Spagnoli, Santa Maria Novella, Florence, Italy.

THE QUANTUM DECAMERON

Short Stories

By
Giancarlo Borgonovi

The Quantum Decameron
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PREFACE

Soon after the end of World War II, when times were hard, a very prolific Italian author was asked to write a piece for an important newspaper. While he was happy to make some money on it, he was disappointed that his contribution had to be limited to one column only. Words usually flowed like a river from his pen and the imposed length limit on the text was for him a source of frustration. He very eloquently described his feelings in a letter to a friend as follows: "I feel like a horse that has been invited to pee in a shot glass (*bicchierino da liquore*)."

The author of this booklet is all but a prolific writer. That is why it took him a while to put together one hundred stories, in order to justify the connection with the Decameron. With the above sentence in mind the author describes his feelings as follows: "I feel more like an old man struggling, uninvited, to release a few drops into a very large *vespasiano* (term used in Rome to denote public urinals, apparently introduced by the emperor Vespasian, and existing, until few years ago and in a more modern form, in many streets and squares of the Italian capital).

The field of physics, both classical and quantum, is very large indeed. The field today is arguably not as fertile as it was at the end of the 1800s or at the beginning of the 1900s (at least in terms of discoveries that can be comprehended by the average person), but it is vast enough to offer opportunities for humor. In this spirit, the short stories in this book have in common some implausible connection with the world of physics, more quantum than classical, and some attempt to racy humor, hence the name Quantum Decameron. Thus, they will probably be appreciated most by people with some scientific or pseudo-scientific background, and maybe also having some connection to Italian and Brazilian language and culture. Not a very large group, with all these characteristics, but hopefully others will have a laugh or two.

During the preparation of this book the world went through a pandemic, which in a way reinforced the connection with the Decameron, where the stories are narrated over ten days in a period characterized by a plague. Accordingly, to make the connection closer, the stories have been organized in ten *giornate*, or days.

Two apologies are in order. The first one is to Giovanni Boccaccio, for

appropriating the title of his immortal work. The second one is to anybody who may have been offended (it is so easy to offend someone these days) by some of the material depicting interactions with subjectively sensitive human categories, such as gender, race, religion, politics, and so on.

ACKNOWLEDGMENTS

The author would like to thank all the entities, organic and inorganic, that have provided inspiration for the stories in this book. This includes persons, living and dead, but also characters from novels, operas, plays, and so on. The latter are often more universally known, and in a sense more alive, than the authors, composers, or playwrights who created them.

A special thanks to the author's daughter, Veronica Borgonovi, for providing editing help, and for making suggestions intended to help the author better understand the potential offensiveness of some sections with regard to gender, race, religion, politics, and so on.

PRIMA GIORNATA (FIRST DAY)
STRANGE STORIES

The stories narrated during this day are somewhat weird. This is not to say that the stories in the rest of the book are not weird. Surely not, since the entire book is weird! It is just that they are, perhaps, a little weirder than the others. They may share with the other stories some common elements, and some could easily have been told in a different *giornata*. Hopefully, and in spite of their weirdness, they share with the other stories in the book a sense of internal, self-consistent logic, and a respect for the truth of historical and literary characters and events referred to, without which no moral purpose could even be claimed. And of course, just like the other stories, they contribute to the unity of the book by having a connection, direct or indirect, to some aspects of the world of physics.

An old gentleman has a singular experience at the Paris opera. The contribution of cats to science. A dialogue between the wine and the oyster. An international meeting of the five senses. The world seen from the perspective of a virus. These and other stories are narrated during this day.

Singularity at the Paris Opera

In mathematics a singularity is a point where a function becomes infinite, sort of a vertical asymptote. In physics, it may represent the point where the potential tends to infinity. In modern astronomy and cosmology, the word refers to a point of infinite mass and density inside a black hole. In general, a singularity is isolated and stands out.

Baron Gerard de la Vallière was the opposite of a singularity, you could have called him an anti-singularity. Born in an aristocratic family in the Loire Valley, he had inherited a number of social traits that made him very congenial and easy to get along with. First at school, then briefly in the Army, then in a long career in the diplomatic corps, Baron de la Vallière had always been surrounded by circles of people he knew. A bachelor all his life, and now retired from the service, he was known to attend all kinds of social functions, and was always seen in the middle of company. It was now the peak of la Belle Époque in Paris, and the Baron was sitting in the center of the orchestra section of the Opera theatre, waiting for the

performance to start.

The venue that night was *L'Italiana in Algeri*, or *The Italian girl in Algiers*, by Rossini, and the Baron was musing about the time he had spent in Algiers, about thirty years before, when he had been sent there by Napoleon III. The relationship between France and Turkey had gotten sour, as it was believed that the Ottomans were acquiring some new super hard steel manufactured in Essen, Germany. It was also believed that the steel was going to be used for fabricating very advanced, newly designed scimitars that would have threatened the stability of Europe (weapons of mass decapitation, they were called). All the chancelleries in Europe were on high alert, and there had been calls for war. The trip to Algiers by Baron de la Vallière had contributed to defusing the issue, thanks in part to his natural instinct for accommodation and to his amicable disposition.

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The first act of *L'Italiana in Algeri* ended with long applause and Baron de la Vallière left his seat for the foyer. In his old age he had to be careful, so he went to the restroom first. The restroom had been recently renovated, the world was changing, and instead of the servants offering you a bowl of water and perfumed towels to wash your hands, a new self-service system coming from America had been introduced. You had to turn a device called a faucet, sort of a valve, wash your hands under a jet of water, and then reach for a roll of paper towels.

After doing his thing, the Baron looked at the instructions and turned the faucet open. Either he was inexperienced, or the system had not been tuned properly, but the water erupted with great pressure, scattered from the surface of the sink, and splashed on the Baron's suit, considerably wetting his pants near the groin. "That is the progress that we get from the other side of the Atlantic," remarked the Baron to one of his acquaintances that was just getting out of the restroom, then philosophically tried to dry himself with the paper towels.

*****

Mr. Duval, an investment banker with an office on one of the new Grand Boulevards, got out of the restroom and rejoined his wife and a group of friends at the left side of the hall. "I saw de la Vallière in the restroom," he said discreetly to his wife. "The poor guy is really getting old. He splashed water all over himself." Duval could not help being overheard by two

ladies in the back.

*****

In the center of the theatre hall, circles of old aristocrats and new rich were happily gossiping while enjoying drinks and finger food. “You know what I just heard?” said a new arrival into one of the circles. “Old de la Vallière peed all over himself in the restroom.”

*****

At the right side of the theatre hall, circles of military officers and politicians were commenting on the news of the days, carefully avoiding talk about the Dreyfus affair, which was a very divisive issue. Madame Lafour, who had a considerable reputation as a source of reliable news, inserted herself into one of the circles. “Baron de la Vallière had a terrible case of diarrhea in the restroom,” she said. “He is covered with it. He stinks.”

“Good lord!” said the Ambassador of Parador to his wife. “And we are sitting just behind him. We do not want to embarrass him, so we better leave now.”

*****

The second act of *L’Italiana in Algeri* started. Baron Gerard de la Vallière was sitting at his place near the center of the orchestra section. He could not figure out why the seats around him, for an average radius of maybe seven or eight seats, were completely empty. For the first time in his life Baron de la Vallière felt like a singularity.

Of Admirals and Nieces

Many years ago, we used to spend several months of the year in a village along the coast of Normandy. Actually, it was not even Normandy, but that does not matter for the purpose of this story. The village was not far from Balbec and other localities that you can only find described in literary works. It had a large hotel, which during the summer season was populated with different characters that had escaped from novels and plays. La Belle Époque was mostly represented, but there were also a good number of characters drifting in from Hemingway’s novels and the Spanish Civil War.

Because of our long association with this establishment, we had absorbed the traditions and become part of the local background of habitués. Since time immemorial we had been observing the constant stream of deposed dictators and decaying prima-donnas that were passing through. Therefore, although we kept our opinions mostly to ourselves, we felt that we had acquired a right to set the standards of good behavior, by subtly expressing approval or disapproval. I remember in particular a group of aging British ladies in our midst, who had developed a special sensitivity and an associated body language to express aristocratic disdain towards what could have been broadly described as lower instincts.

For some reasons that were never fully explained, during a certain period between the Spanish American war and the discovery of quantum mechanics, the hotel became popular with Admirals. There must have been a network operating in Admiraldom all over the world, because we had Admirals from faraway places in all the five continents. I remember Admirals from China and India, Admirals from small developing African countries, as well as Italian *Ammiragli* and South American *Almirantes*. We even had Admirals who had nuclear energy experience, acquired from commanding submarines and carriers.

All these Admirals had one thing in common. They were all accompanied by a young woman, usually very pretty, who happened to be their niece. I have long searched my memory and up to now I have failed to remember a single Admiral who did not have a niece at his side, so I have sometimes wondered whether this was part of their job requirement.

During their stays, which sometimes lasted several weeks, the Admirals and their nieces often became the center of attention in the limited social life of our hotel. The British ladies listened attentively while the old gentleman described details of the naval battle at Trafalgar, or intrigues for the control of the China Sea. The men were taken by the devoted attention that the young lady, usually from the Caribbean Antilles or the Indonesian islands, would profuse on her beloved uncle.

One day a French Admiral arrived, with la nièce, of course. At the time of introductions, one of the British ladies went over to him and pointedly said:

“The niece, I presume,” to which the very surprised Admiral replied:

“How do you know that her name is Denise?”

The Last Flight of Mr. Galeazzo

Mr. Galeazzo was lying in bed. He had trouble sleeping and was thinking about his life. He had been born in Italy and in the first part of his life had had to tolerate jokes about his name from fellow students. Galeazzo … *testa di cazzo* (prick head). It was inevitable. Things got better with age, and even better moving to another continent, although now and then Galeazzo would meet someone with a rudimental knowledge of the Italian language who would make some implication. Not too long ago, an old professor who had just met Galeazzo, had wondered aloud, "Galeazzo, Galeazzo… rhymes with what … paparazzo…" and had a sly smile on his face.

Galeazzo had been interested in physics all his life, especially quantum mechanics. He was an admirer of Richard Feynman, and had discovered some common characteristics with the great scientist. Feynman was born in 1918. Galeazzo was born in 1938, twenty years later. In 1951 Feynman had gone to Brazil, where he had spent a year, teaching, continuing his brilliant research, and chasing women. Galeazzo had gone to Brazil, for one year, in 1971, twenty years later. He did a little teaching, some trivial research, and attempted to chase women. Feynman had passed away in 1988, and Galeazzo figured that his time would come in 2008, exactly twenty years later.

When Galeazzo had exposed these facts to some of his friends, they had laughed him off. Feynman got a Nobel prize in 1965, they said, you did not get one in 1985. And so on. Still, deep down, Galeazzo remained attached to his similarities with Feynman.

Galeazzo kind of woke up, and realized he was not alone in bed. Since his wife had left him, he had been sleeping alone. There was a woman lying next to him. She was turning her back towards him, and Galeazzo had his arm around her. He could feel her firm breasts and buttocks and an increasing desire to explore more. Who are you, he murmured. I am Death, was the answer. For Death, you smell awfully good, he heard himself say.

Hold on to me, and we will go on a flight, Death said. She was a trim woman, with dark complexion and hair. Somehow, they lifted off from California and soon they were flying high over the continental United States. Galeazzo was surprised that he could see everything in minute details. Not only he could see, but he could immediately understand everything he saw, down to the minute details.

They flew over farms and ranches, and Galeazzo could immediately absorb all the issues from seeding to harvesting. They flew over factories, and he could immediately figure out all the problems of design and production. The content of entire libraries would be immediately downloaded to his brain. Going over a famous university, he could see a professor lecturing. The blackboard was full of equations, and Galeazzo understood all of them and beyond.

In addition to the present, Galeazzo could see the history of the land below, all the conflicts and the struggles from day one, and everything made perfect sense. They were now flying over the Atlantic, and Galeazzo was instantly capturing oceanography, marine biology, geology, weather prediction, navigation, even seafood gastronomy.

The coast of Spain appeared and Galeazzo could immediately absorb the language and culture of the country. He could do multiple things, have several meals, dance flamenco, run with the bulls, and still experience the conquest of the Moors and the battles of the Civil War.

The rest of Europe went fast, but he could not say how fast, since time, it seems, had ceased to exist. Did they really fly over the Orient, or did he already know everything about China and Indian religions?

As the sun was rising, they reached South America and landed in Northern Brazil, somewhere North of Recife and South of Bahia, a hard-to-find place. It was a secluded bay, with dunes dropping to a white sandy beach. At the top of the dunes there were all sort of tropical fruit trees, and a light breeze was bringing mysterious scents and sounds.

“Do you want to make love to me?” said Death. “I thought you’d never ask,” said Mr. Galeazzo. They accommodated themselves at the entrance of a natural cave and began to know each other. Galeazzo found strange that, although he now knew essentially everything about the world and human activities, he seemed to have forgotten everything about sex. It was just like the first time.

But Death was an experienced teacher and she deftly handled the situation. Galeazzo started moving, slowly first, then faster and faster, until the spasm came and he cried out.

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The neighbors found the dead body of Mr. Galeazzo, sometime in 2008. He was lying in bed and had a happy but strange expression on his face. “He

looks like he knows everything," commented someone.

Mrs. Steinman's Revenge

Sometime in the 1920s or 1930s, a lady by the name of Rosa Steinman started on her path to cultural and social prominence in an industrial city in the American North East. Her husband had accumulated a substantial fortune through a series of successful investments, and Mrs. Steinman had gradually become more and more involved in supporting the arts, with the major share going to the promotion of opera. Although Mrs. Steinman would not have confessed it, she loved the social more than the cultural aspects of the functions that were associated with opera, and the aura of respectability that it conferred on its devotees.

One day, in anticipation of the premiere of Don Giovanni, Mrs. Steinman organized a social function at her house. She decided to extend an invitation, in addition to her habitual entourage, to a very prominent lady, Mrs. Vandersilt, who was (as Mrs. Steinman herself would have been willing to admit) much above the rest in the social and cultural status of the community. By this time, Mrs. Steinman felt that her status had grown enough that she could stand on her own feet and invite the all-powerful Mrs. Vandersilt.

The response did not take long to arrive and was a bitter disappointment for Mrs. Steinman. The fancy reply card contained only a quote from Lorenzo da Ponte libretto of Mozart's Don Giovanni:

"*Non si pasce di cibo mortale*

chi si pasce di cibo celeste."

Mrs. Steinman was not so cultured as to know right away the meaning of the quote, but it did not take her long to figure out that the phrase, which in the opera is the reply of the ghost of the Commendatore to Don Giovanni's dining offer, meant "The one who eats heaven's food does not eat the food of the mortals."

Mrs. Steinman correctly understood that this was an abject rejection of her invitation, and was deeply offended. This started a bitter war that lasted for several decades. It is generally thought that the raging battles of those years were fueled by the prohibition, but it was really due to the conflict between the two ladies. The St. Valentine massacre was just one example of the

consequences of that rift.

Later on, for various reasons that have to do with international diplomacy, the war ended (at least on the surface). The two ladies saw each other at social functions and exchanged pleasantries. Deep inside, however, Mrs. Steinman still felt the sting of the slight to which she had been subjected. By that time, the salon of Mrs. Vandersilt had branched out into science and had grown to include an interest in quantum mechanics. By bringing together an eclectic group of artists and scientists, Mrs. Vandersilt had succeeded in organizing the representation of an opera, Fission, based on the achievements of Enrico Fermi. The highlight of the opera was to be the Chain Reaction march, for orchestra and Geiger counters, characterized by a catchy musical phrase that grew slowly into a deafening crescendo.

Expectations were high in the cultural circles for the opera's first showing. Although Mrs. Vandersilt had insisted on realism in order to impress the critics, it was generally believed later on that she had not intended to go that far. Rather, the bringing in of real Uranium-235 and the subsequent criticality accident that took place on stage was blamed on Mrs. Steinman. Due to the destruction of many documents and the disappearance of all the characters involved, we shall probably never know the entire truth. What we know for sure is that several city blocks were leveled and the entire county had to be decontaminated. To our knowledge the opera has never been produced again.

Of Phones and Men

X had been trained as a physicist, but he had worked all his life for a company that provided studies on a variety of issues for a variety of customers. Accordingly, he had also been involved in statistical analysis of large data and he had some experience in finding correlations. After retiring, X began observing social patterns and discovered (or he believed he had discovered) an interesting phenomenon. The number of disputes, of any kind, was increasing with the number of cell phones entering the market and with the number of messages being exchanged. He postulated that this pattern was somehow related to the fact that people were responding almost instantaneously to the messages being received, instead of taking some time to answer. X may have developed this theory partially based on observations within his own family.

Accordingly, X began to work on some ideas to correct this phenomenon. One possibility would be to develop some software (an "app," to use a horrible word currently in use) that would analyze the arriving messages and compute a figure representing the hotness of the message, some kind of red flag. Depending on the degree of evaluated hotness, the receiver could not respond immediately, or send another message to the person, until some amount of time had elapsed. Innocent messages could be answered right away, but hot messages would require some delay. In very extreme cases, the responder would be required to write a short funny story and attach it to the message (!).

X thought that this would be a good idea, which would bring more peace to the world and reduce the number of disputes, so he tried to promote it. Unfortunately, the NCA (National Cellphone Association) mounted a campaign against it (phones do not argue, people with phones argue, was their story). Between them and the manufacturers of phone equipment they bought all the politicians. Candidates for the coming presidential election were also against the idea.

X was discouraged, but he thought he could promote the idea with support from the organized religions. He contacted the Pope, who tweeted an angry answer and excommunicated him. He contacted an Ayatollah who put out a death threat on him.

By this time X had spent almost all of his resources and had got nowhere. He had heard that on a remote peak in Asia lived a great guru, the mother of all gurus, a gurissimo. He thought that maybe this guy could help him. So, with his last money he bought a ticket to Asia and then embarked on the strenuous way to reach the peak. After days of walking and then climbing he finally reached the top of the peak and saw the guru, who was sitting looking down at something.

X approached and started to formulate his question, but the guru looked up and stopped him by saying: "Just a moment my friend. I will answer your question as soon as I finish responding to this text message that I just received from a son of a bitch in Pittsburgh…"

A Partial Interview

For reasons that have not yet been explained, a local television station conducted an interview with Professor Gianluca Baragatti. The following is

a transcript of a portion of the interview that was conducted, before its interruption.

Interviewer (Int). "Professor Baragatti, thanks for being here. We heard good things about you, like you are a most peaceful gentleman and never use bad language. How are you?"

Baragatti (Bar). "As in all humorous stories, into which I have been constrained by my condition as a fictional character, there are bad news and good news. The bad news is that I am getting old, which is no fun. The good news is that up to now I have not experienced serious illnesses: I have not become a vegetarian, I am still a free spirit, and I have not converted to any religion."

Int. "Are you implying that vegetarianism and religions are actually diseases?"

Bar. "Yes."

Int. "Let us move to less controversial subjects. Your character is often associated with episodes which have an implausible connection with physics, predominantly quantum physics. How much do you actually know about quantum theory?"

Bar. "Very little. I have a degree in physics from a prestigious Italian university. I worked both in academic and industry environments, on too many subjects for too little time, so I never became a specialist in a single field. And I tried to read some physics books on the side."

Int. "I see that you are now retired. Are you enjoying a comfortable retirement? Do you consider yourself a bourgeois?"

Bar. "Yes, and, regrettably, yes. On the first question I consider myself lucky, because, even though I made a number of errors in my professional life, the environment was such that the errors did not have much impact on my status. Perhaps it was the research environment that allowed considerable freedom to recover from mistakes. If a carefully planned experiment failed miserably because of gross negligence, we just wrote that we had done a different experiment. In similar situations an old colleague of mine, Dr. Greeninski, used to say: "Good enough for government work." On the second question, I am reminded of a song by Jacques Brel, Les Bourgeois, where the character gradually goes through the aging process from young rebel to old solid citizen. Regrettably, I am getting there."

Int. “Who has had the most significant impact on your life?”

Bar. “My wife, Berenice. As should be abundantly clear from the stories in which she and I have been made to appear, she is the only one with a healthy dose of common sense.”

Int. “Is she a fictional character too?”

Bar. “Of course.”

Int. “Do you have children?”

Bar. “Yes, I have two daughters, Vanessa and Belinda.”

Int. “I assume they are fictional characters too.”

Bar. “Your assumption is correct.”

Int. “Who is your favorite author?”

Bar. “Luigi Pirandello. Characters appeared to him and he gave them life. In all his production, nothing is more evidence of that peculiarity than in the play *Sei personaggi in cerca d’autore, or Six characters in search of an author.* In that play, six fictional characters, mostly members of a family, suddenly appear to a group of actors who are busy rehearsing a theatrical piece. They plead with the director until he and the actors agree to interpret their story on the stage. From then on, the play proceeds between alternative realities, with great dramatic effects.”

Int. “At this point in your life, what do you regret most?”

Bar. “As a fictional character, I wish that I had encountered a real writer, like Pirandello, who could easily have given me immortality. Unfortunately, I met this guy, you know who, and he suddenly decided to impersonate an author and write a little book with silly short stories. Worse, he has compromised us by putting me and Berenice in some of his ridiculous stories.”

At this point Professor Baragatti became visibly distressed. He said that he felt like a small amount of a fast decaying radioactive isotope, and consequently he would have a short life, both in time and space. The interviewer tried to calm him down, saying that perhaps he would live longer than his writer, but was unsuccessful. The professor started using bad language against the author that was putting his stories on paper, language that is not proper to report here, and the interview was quickly adjourned.

A Different Perspective

George Otterman was the editor of the only newspaper in a small town in a western mountainous area in the United States. He had just finished writing an editorial in which he strongly recommended that all readers stay home, because of a pandemic that had begun to sweep the country. He was preparing to give the authorization for printing the weekly edition of the paper, *The Flat Valley Advocate*, when something appeared on his computer. It was not an e-mail, and it was not coming from a website, or from any social media. Even his ten-year-old grandson, Teddy, who was a computer whiz, could not identify where the information came from. "I do not know, Grampa," said Teddy, "Maybe your computer has been hacked and you got a virus."

George realized that the message, or whatever it was, represented a different point of view. Because he believed that in order to get to the truth one should consider all opinions, no matter how weird they are, he decided to include the message in the current edition of the local newspaper. The following is a faithful transcription of what appeared in *The Flat Valley Advocate* and, frankly, seems to us to be a rather rambling message:

> *As I write this, I reflect on our long history and on our past greatness. I am well aware that what we consider "long" is extremely relative, especially when we look at things from a cosmic point of view. However, nobody can deny that we have made great strides since the time we appeared on the face of the earth. I am writing this now because there are ominous signs that our species may be doomed to eventually disappear. I consider myself very lucky since I have lived in a period of peace and increasing prosperity. When I look at our history, I am amazed at how we propagated over the earth, from early colonization to maximizing usage of the tourist industry. We enjoyed taking cruises on gigantic ships and flying to far away countries. We went to beautiful restaurants and participated in countless cultural events. I remember the time when I was going to the opera, and I even got introduced to a very famous diva. It was a very rewarding and productive time for us. Yes, culture did a lot for us, why do you think we are so well rounded? We were also good at sports. Even though we were not very large, we particularly excelled in long jumps, often several times better than what*

was expected, and even over some barriers. I am especially proud of what we have achieved in terms of human rights. Verbal communication has helped us prosper. In spite of what you may read about us favoring certain segments of the population, like older people, I can assure you that we do not discriminate, period. Even the Governor of New York has recently emphasized that we do not discriminate. Whether you transport potatoes by driving a truck or solve the transport equation with a supercomputer, we will treat you the same. In any case, I have long been a student of history and I am well aware of the rise and fall of empires and civilizations. As a matter of fact, about a hundred years ago we witnessed something similar to what we are experiencing today, with the demise of a very promising civilization and culture. Currently, experts are collecting data and trying to predict what will happen. Unfortunately, we now see signs that the rapid progress we have made may not only end, but that a period of great recession may begin. Let us face it. It has become more difficult to procure food, and suddenly, our formerly generous hosts are turning their back on us. Obviously, we try to delay as much as possible the flattening of the curve, but in reality, nobody knows what is going to happen and many rumors are going around. A friend of mine, who has a relative that is very informed (he was even introduced to the President of the United States) told me that there is an even more terrible menace on the horizon, which threatens to wipe out our very existence: a "vaccine."

The Importance of Cats in Physics

Some years ago, the Science Subcommittee of the International Society for the Empowerment of Cats was meeting in Switzerland. An important aim of the Society was to foster recognition of the contributions made by cats through history. In America the Society had gone a long way in expanding the rights of the feline population and had become a powerful lobby exerting a considerable influence on both branches of Congress. The membership was very active and they had urged their elected representatives to study and adopt the methods employed by other organizations, such as the rifle association and the women's movement,

which had been very successful in pushing their revindications. But in other countries the Society had also reached high levels of support, and that is why international meetings like this were taking place.

This time the subject was physics, and delegates from several countries had come to attend the "Cats and Physics" meeting. After the ritual welcoming speeches by the mayor and the president of the local university, the subcommittee members set out to work.

"As you are well aware, cats have had an important role in the development and teaching of physics," said the conference chairman. "The agenda for today will deal with three areas in which cats have been instrumental: electrostatics, dynamics, and thought experiments in quantum theory."

With regard to electrostatics, copies of an extract from a very popular introductory physics text book were circulated. The book was *Electricity and Magnetism*, by Francis Weston Sears, Addison-Wesley Press, 1951. On page 5 one can read the following sentence:

If a rod of hard rubber is rubbed with cat skin and brought near a ball of pith suspended by a silk fiber, the pith ball is first attracted by the rubber, but after a moment of contact it is repelled.

The attention of the group was entirely focused on the word cat skin. Careful research had documented that millions of cat skins had been used over the years in electrostatics demonstrations. The animal support groups, who had violently protested against furs been worn at opera opening nights and the like, had largely been silent. The committee members felt that a strong condemnation was in order, but arriving at an agreement on the language was not easy. The delegate from Armenia wanted to use the word genocide, but encountered strong opposition by the delegate from Turkey. Someone suggested using the word Holocaust, but this encountered even stronger opposition from the delegate from Israel. Finally, cooler heads prevailed and a joint communique was issued with somewhat watered-down language, not uncommon in international meetings.

The second subject on the agenda dealt with dynamics. It is known that cats always fall on four legs, even when dropped on their back. It is also known that a body not subject to external forces maintains its angular momentum. Now, angular momentum implies rotation. If a cat is dropped on its back and without rotation, therefore no angular momentum, and is not subject to external forces during the fall, how can he rotate himself? This question intrigued famous scientists such as Stokes and Maxwell in the last part of

the 1800s. Apparently a full explanation was given only in the 1960s (I mean one with equations and computer modeling). It takes a combination of bending, torsion, retraction, and extension of the legs to modify the moment of inertia (of the cat) and attain a rotation, all while not changing the angular momentum.

NASA even supported experiments involving cats falling in order to learn how astronauts could best maneuver in space. Galileo made experiments letting objects fall from the leaning tower in Pisa. To follow his lead, a large number of poor cats were made to fall while also being subjected to high-speed photography, with no regard for their privacy. It is possible that some of the animals, because of slow reflexes or other factors, were unable to make the rotation in time and ended up being hurt. In this instance there had also been no condemnation from the animal lobbies. The delegates quickly agreed to a unanimous resolution recommending severe sanctions against any country that would allow cat-dropping research.

During the lunch break a young student, who had been allowed to attend the meeting as an observer, respectfully asked a question. “Should cats not get at least some credit for computed assisted tomography? It was developed by physicists, and it is universally known as CAT scanning.” The remark fell into an icy silence. “Young man,” said the chairman sternly, “are you trying to be fresh? We are doing serious work here, not looking for puns.”

When the committee work resumed, the delegates were in a good mood. They quickly moved to the third item on the agenda: the contribution of cats to the development of quantum theory. The Schrödinger cat was an important part of a thought experiment, being simultaneously in two states, alive and dead. As far as we know, no one has tried to do the actual experiment, which uses the randomness of radioactive decay to trigger the deadly poisoning of a cat in a box. Not because it would not be fun to do it, but because in order to get statistically significant data one would have to replicate the experiment a very large number of times, well over the budget of the funding agencies, and so on.

As it is, quantum mechanics is more benign than electrostatic and classical mechanics. On this conclusion the committee reiterated that cats had been instrumental in the development of physics and adjourned for the day. The delegates prepared themselves for a nice evening in the city that was hosting them.

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After a number of years, it appears that the work of the Society has borne fruit. If you google *pith ball* you will find reference to electrostatics and the transfer of charge. The *rod* and the *rubbing* are still there, but the *cat skin* has gone, replaced by *silk*. Hopefully someday the importance of silkworms in the development of physics will also be recognized.

The Meeting of the Five Senses

The five senses met in a little village in Switzerland. They called the meeting the State of the Sense, but, unlike the State of the Union or similar events by presidents and other heads of state, it was not on a fixed schedule, like yearly or some such thing. Rather, the senses would meet whenever it would make sense to have a meeting. Perhaps because of some kind of change in the world, maybe in the universe. After all, you would expect the senses to behave sensibly.

The five senses came together because, according to some new neurological studies, the number of senses was actually supposed to be seven, not five. The two additional senses were called *vestibular* and *proprioception*. *Vestibular* corresponds to the perception of our body in relation to gravity, movement, and balance. An example of this is when one feels the motion of an elevator. *Proprioception* is the sense of the relative position of neighboring parts of the body and the strength of effort being employed in movement. An example of this is when people close their eyes and touch their nose with their middle finger. If you have not heard of these two additional senses you can look them up.

The classical five senses were understandably pissed off at the idea and did not take kindly to what they considered an intrusion into their domains. They were, and actually are, very conservative and in favor of barriers to keep undesirables out.

“This is **sensational** and should not be allowed,” said the Sense of Sight, who was the oldest and the most respected of the group. “Since the origin of time we have been the tools by which most living animals register experience, and I mean physical experience. Spiritual experiences and those sorts of things do not concern us. That is why we are closely connected to the physical sciences, physics, chemistry, molecular biology. I, for example, am closely related to **Optics**, including its quantum

advances, lasers, LEDs, and so on."

"And I am related to **Mechanics**," said the Sense of Touch, "I am the one that would be most affected by the introduction of those two aliens, pardon me, undocumented new senses. You see, people think that I sense only through the skin, so much so that the **sensuous** and sexual aspects of my sphere of influence have been overemphasized. In reality, I sense forces and pressures not just on the skin, but on all organs. A weight on the head is a form of touch, right? Then, a pressure on an internal organ caused by a gravity field or by an acceleration is a form of touch too. That is part of my domain, and that's why it is idiotic to invent a new sense when people feel the start of an elevator, even with closed eyes. Heck, some of those liberals would even come up with a new sense for the feeling of farting."

"That one could also come under my domain," said the Sense of Smell, "but I do not want it, I prefer to concentrate on perfumes, especially those for which men are very **sensitive**. In fact, some men should be called *scent-sitive*, for their ability to detect the scent of a woman. I am connected to **Fluid Dynamics** and I also reject the introduction of new senses."

"You are absolutely right," said the Sense of Taste. "While globalization and the Internet have dramatically expanded the knowledge and appreciation of ethnic foods around the world, I recommend a **sensible** use of them. Do not overeat, period, otherwise you will not be attractive to the opposite sex. And by the way, while cold foods can be delicious, most of gastronomy products require heat, which is why my closest association is with **Thermodynamics**."

Last but not least spoke the Sense of Hearing. "Since we all agree, we should issue a strong condemnation about the introduction of additional senses. We can also inspire demonstrations with signs such as "Down with Vestibular" and "Down with Proprioception." For obvious reasons I have been closely associated with **Acoustics**, and I have witnessed the growth of the **sensorial** field, with the proliferation of sensors that detect and amplify sound. The hearing aid industry has made extraordinary progress, as is evident by the explosion of one-page ads in every national newspaper. It is unfortunate that these devices often fail when it comes to husbands listening to their wives."

At this point some sensation was in the air. Nothing to see, hear, touch, smell, or taste. "The Sixth Sense is trying to crash our meeting," said the Sense of Sight. "We have known that one for a long time. He is associated

with **Metaphysics**, and he is the one that informs wives when their husbands misbehave. I wish that we could beat him **senseless**, but I am afraid that he would not feel anything."

When the meeting was over the five senses left after greeting each other with high fives. It is unclear what the actual results from the meeting were, since references to *Vestibular* and *Proprioception* continue to appear in the literature.

Dialogue between the Wine and the Oyster

"Hello, are you there?" The wine was getting impatient. So many times he had tried to engage in conversation with the oyster, and he was getting nowhere. The oyster was staying closed, you could say she was clamming up. Finally, there was a slight movement, the oyster opened up a tiny bit, and her voice was heard. Actually, it was a yawn.

If you wonder why the wine is masculine and the oyster is feminine, it is because this is so in Italian (il vino, la ostrica), in French (le vin, l'huitre), and in Portuguese (o vinho, a ostra). This may not be so in other (barbaric) languages.

"You always stay locked up and do not enjoy life. Look at me. I am bubbling, without me there would not be splendid opera scenes and great arias, like in Traviata, *Libiamo ai lieti calici*, and so on. But what do you do, all the time, locked up like that?" inquired the wine.

"Why, I read and study a lot of different subjects, literature, world affairs, even quantum mechanics. It helps that I figured out a way to connect to the internet." The oyster was now slightly ticked off since she had been disturbed, so she launched into a tirade. "You are totally overrated. You need a bottle, a cork, a fancy label. You need to be advertised with a lot of fancy words, the bouquet, the subtle flavor of berries, the microclimate, lots of hot air, in my opinion. In contrast, I am just purity, nothing but myself, and occasionally I can create a pearl."

The wine was silent, surprised by the attack, and the oyster continued:

"Yes, you are totally overrated and I can demonstrate it. When you, I do not mean you, I mean people, go to a restaurant they pay at least four times what they would pay buying the same wine in a store. Not to mention bottles that are sold for hundreds and thousands of dollars. With me things

are different, you can buy oysters at a fish market for a dollar to a dollar fifty a piece. In a restaurant, unless it is very upscale, you do not pay much more. In fact, a friend of mine, Professor Gianluca Baragatti, found a place where the happy hour includes oysters at one dollar a piece. My point is that we oysters are purity, simplicity, and do not need publicity to increase our value. We are down to earth, actually down to the sea, and can do without all that hoopla that you guys use to promote yourselves."

"Well," said the wine, "I for one am proud of the fact that I can inspire feelings of joy. You have no idea how many fires I have created in the hearts of men and women, and how many love stories have followed."

"Yes, you may start things, but you do not follow up on them. And I say that on the authority of Shakespeare. None other than Shakespeare! In Macbeth, Act II, a character states that drink provokes three things. Asked as what the three things are he replies, and I quote: "*nose-painting(*), sleep, and urine. Lechery sir, it provokes and unprovokes; it provokes the desire but it takes away the performance."* I, on the contrary, am the one that gives sexual strength. It is a well-known fact that oysters are an aphrodisiac and may be considered a kind of natural Viagra. Also, I believe that we contributed to the development of quantum mechanics."

"That I find hard to believe."

"Listen to me. Have you heard of the Schrödinger equation?"

"No, but I heard of the Schrödinger cat."

"Same thing, no, I mean the same person is responsible for both concepts. While the cat is a useful paradox, the Schrödinger equation is a very important part of quantum mechanics. You probably do not know that the theory behind the quantum revolution was created by very young people, in their twenties, and I mean Heisenberg, Pauli, Fermi, Dirac. The Germans used the name *Knabenphysik* (boy's physics) to describe this phenomenon."

"Erwin Schrödinger," continued the oyster, "was different. He was older than the other young geniuses, and was having an affair. He went off to an alpine resort on a two-week vacation with a woman other than his wife and during that time he came up with the famous equation. A great mathematician, Hermann Weyl, a guy that even Dirac confessed having trouble in understanding, is quoted as having said that *Schrödinger did his great work during a late erotic outburst in his life*. I cannot prove this, but I

suspect that oysters were consumed in that alpine resort. And now I shall go back to my studies."

With the above statement the oyster retreated into her shell.

"Hello? Hello? She is clamming up again," said the wine. "I guess I shall go back to aging, so I will become even more valuable. I bet she will not be able to do that."

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(*) Red nose, I guess

SECONDA GIORNATA (SECOND DAY)
STORIES CONNECTED WITH ITALY

The stories narrated during this day have something to do with the country of Italy. When people think of Italy, they may have an image of pizza and mandolins, which is partially true, but Italy is also an important country in many fields, including physics. How about Galileo and Fermi! Hopefully, these stories will convey a sense of the diversity in the country and will give to its literary, historical, and gastronomical aspects all the due respect, without which no moral purpose could even be claimed. And of course, just like the other stories, they contribute to the unity of the book by having a connection, direct or indirect, to some aspects of the world of physics.

Recording of dreams in Naples. The discovery of radioactivity in the same day of a disastrous defeat in Africa. Professors of physics honored with statues. The danger of certain translations. These and other stories are narrated during this day.

Misunderstandings

I am preparing my luggage to go back to my country and I am reflecting on my experience, or adventure, if you want to call it that. All in all, with what I know now, I consider myself fortunate, because it could have ended in a much worse way.

I am an Italian man, 36 years old, never married, and not very successful with women. I do not have much education either, I did not finish my studies at the university. My parents left me some money, so I can take some occasional trips around the world. I do speak some English, enough to manage simple conversations, but not sufficiently well to appreciate the nuances. And that is what got me into trouble.

I have a cousin who studied physics and got a position at CERN, in Geneva. He is smart, knows a lot of things that I cannot even begin to understand, and is now spending a year at Columbia University in New York. He is also single, so I figured I could visit him and maybe he could show me around the Big Apple. A few years ago we had spent some good time together, he was fun to be around. However, I found him totally

changed. He has become a total nerd, and it looks like he is totally immersed in some kind of abstract space.

As a consequence, I got bored the first day I got here, and not knowing the city, I felt like a fish out of water. Then by chance I met a fellow by the name of Al, I believe short for Alfred. He is an Italian American, but he speaks no Italian and I had to manage with my English. Al mentioned that there was a place in Little Italy where an ethnic type organization, somehow related to the Italian community, was organizing a family-oriented ball. He said I could attend the ball, which was to take place in an area annexed to the Church of a Saint of which I forgot the name, so I figured it would be pretty safe.

Of course, my cousin did not want to go, he could not stand these kinds of ethnic associations, and when it came to dancing, he is worse than Dirac. So I went to the place, and bought a ticket to get in. There I found my new acquaintance Al who introduced me to some of his friends. The wine was ok, but the food was strange, although it bore some similarity to what we eat in Italy.

I noticed two things. The first thing was that when I mentioned that I was coming from the town of ***, some people had a slightly adverse reaction, and I thought that maybe they had never heard of the place. The second thing I noticed was an interesting young woman, whom I eventually managed to approach and engage in conversation. Someone had mentioned that this particular girl's father was running a union, a ***sindacato***, or so I understood. I liked that, because politically I tend to the left and I am in favor of trade unions.

After talking to this woman for a while, I do not remember what I was proposing, or trying to propose to do, but I distinctly remember that she said "**I am easy**." Now in Italian that means ***sono facile***, and ***una donna facile***, you know, it means a woman of easy mores. No good Italian girl would say that, so I immediately thought "Wow, perhaps I may get lucky."

So I wanted to say something nice, and I said that she had a very **morbid** skin (I was remembering a song by Modugno, author of *Volare*, called *Nuda, **morbida***). Well, she got offended. I did not know that morbid in English is the same as ***morboso*** in Italian, while morbido in Italian means **soft** and should in fact be a compliment for a woman. Damn nuances! By the way, that is why you can buy ***Torrone Morbido*** in Italy.

To make it up I said that I had a lot of **sympathy** for her, to which she

answered that she did not need any **commiseration**. Apparently, sympathy has a different meaning than ***simpatia***, which in Italy means **liking** or so. In any case she had said that she was easy, ***facile***, no? So, I tried to touch her. Well, she slapped me.

She then must have told her father because two scary characters came by, threw me out of the place, and roughened me up a bit. They also mentioned something about cement boots which I did not fully understand. How was I supposed to know that a **syndicate** may indicate a gangster association, and is very different from a ***sindacato***, which in Italy is a **trade union** which in most cases does not have mafia or camorra connections. My adventure could have been even worse since, as I learnt later, that particular syndicate I ran into was not on speaking terms with a similar organization that had originated from the same city of *** where I live.

My cousin told me that he also had made a gaffe when he congratulated someone for obtaining a position they had been **nominated** to. He did not yet know that **nominated** means being **considered** for the position, since the common usage in Italy of the word ***nominato*** usually means that one has been actually **appointed** to the position. Of course, this was only a minor embarrassment and not a drama like in my case.

The moral of this story is that you should be careful when using words in a foreign language that sound very similar to the ones in your mother tongue. While I shall try to be more careful in the future, I do regret that all English language words are not in as direct a correspondence as ***broccoli*** and ***zucchini.***

Back Translation

For the first time in my life, I feel like Mark Twain. Not that I want to compare my writing abilities to those of the great American humorist, but because of the similarity of something that happened to both of us, and of the reaction to it. As you may know Mark Twain wrote a story, “The Jumping Frog of Calaveras County,” first published in 1865. It is a very funny and entertaining story, which attracted attention even outside America, and it was translated and published in France (“La Grenouille Sauteuse du Comté de Calaveras,” Revue des Deux Mondes, July 15, 1872). Mark Twain translated it back into English and was horrified at seeing what they had done with his writing. In his own words:

I have been at infinite pains and trouble to re-translate this French version back into English; and to tell the truth I have well-nigh worn myself out at it, having scarcely rested from my work during five days and nights. I cannot speak the French language, but I can translate very well, though not fast, I being self-educated. I ask the reader to run his eye over the original English version of the Jumping Frog, and then read the French or my re-translation, and kindly take notice how the Frenchman has riddled the grammar. I think it is the worst I ever saw, and yet the French are called a polished nation. If I had a boy that put sentences together as they do, I would polish him to some purpose.

Mark Twain then proceeds to present his original writing, followed by the French version and by his own back translation into English. Here is a small sample:

Well, there was a feller here once by the name of Jim Smiley, in the winter of '49 —or maybe it was the spring of '50—I don't recollect exactly, somehow, though what makes me think it was one or the other is because I remember the big flume warn't finished when he first come to the camp; but anyway, he was the curiosest man about always betting on anything that turned up you ever see, if he could get anybody to bet on the other side; and if he couldn't he'd change sides.

Il y avait une fois ici un individu connu sous le nom de Jim Smiley: c'était dans l'hiver de 49, peutêtre bien au printemps de 50, je ne me rappelle pas exactement. Ce qui me fait croire que c'était l'un ou l'autre, c'est que je me souviens que le grand bief n'était pas achevé lorsqu'il arriva au camp pour la première fois, mais de toutes façons il était l'homme le plus friand de paris qui se pût voir, pariant sur tout ce qui se présentait, quand il pouvait trouver un adversaire, et, quand il n'en trouvait pas il passait du côté opposé.

It there was one time here an individual known under the name of Jim Smiley; it was in the winter of '49, possibly well at the spring of '50, I no me recollect not exactly. This which me makes to believe that it was the one or the other, it is that I shall remember that the grand flume is not achieved when he arrives at the camp for the first time, but of all sides he was the man the most fond of to bet which one have seen, betting upon all that which is presented, when he could find an adversary; and when he not of it could not, he passed to the side opposed.

Now, I am sure that you will agree that Mark Twain had every reason to be

angry at seeing how the French had assassinated his beautiful writing. A friend of mine has tried to convert that French version into Italian, and properly translated "Il y avait une fois ici" as "Egli ci aveva una volta qui." And when he showed that to an Italian speaking friend, well, the friend laughed and said the Italians do not speak that way, so once again this proves that the French messed up Mark Twain's writing. And that brings me to my own complaint. You see, I have written a few funny stories myself, for my own pleasure and hopefully to amuse my few friends. It so happened that someone in Italy got hold of one of my stories and "translated" it into that language. Some translation! Pure garbage! And I thought that Italy was a refined country, with great literature, Dante, Petrarca, Boccaccio! I have seen samples of their writings, and they make sense, even in English. It is sad to see how low people there have fallen, people that I considered among the most cultured in the world, with the Renaissance, and so on. Although that may explain the results of their most recent elections, and the popularity of that political slogan, something like Make or Fashion Italy Gross Again (MIGA or FIGA), I am not sure.

In any case, to make my point, just as Mark Twain did, I present the initial paragraph from my original story, the horrible Italian "translation" (which appeared on the Internet), and my own back translation into English. Just as Mark Twain did not speak French, I do not speak the Italian language, but I can translate it very well, though not fast, I being self-educated. Here it goes:

Mr. Fritz was sitting in court. He had been brought there by a combination of events both in his life and in the world at large. The events in his life, he felt, had not been that uncommon, but extraordinary changes had taken place in the world, to such extent that it was difficult for him to fit in.

Il Signor Fritz era nel banco degli imputati. Una combinazione di avvenimenti lo aveva condotto lì. Egli riteneva che gli eventi della sua vita non fossero stati poi così insoliti, per quanto eventi straordinari avessero avuto luogo nel mondo, a un punto tale che era difficile per lui adattarsi.

The Mister Fritz was in the bank of the defendants. One combination of happenings him had conducted here. He thought that the events of his life not had been after such unusual, for quantum events extraordinary had had place in the world, at one point such that was difficult for him adapt him.

Now, do you see my point? Do you see the similarity to what happened to Mark Twain? Do I or do I not have reasons to be upset? I hope that nobody

else will try again to translate my writings into Italian, at least not until that nation goes back to the elegance and refinement of the Renaissance writing style.

The DPB Theory

Professor Gianluca Baragatti had retired from the Department of Physics and had a good friend who had retired from the Department of Italian Literature. The friend, Professor Massimo Pirelli, who had a distant relationship with the tire company family, was from Florence and was an authority on the writers of the period that preceded the Renaissance, say the fourteenth and fifteenth century. The giants of this era were of course Dante Alighieri, Francesco Petrarca, and Giovanni Boccaccio.

Pirelli was trying, not always successfully, to also be a bit of a Renaissance man. Accordingly, he tried to develop some knowledge in fields other than his own, had read several books on the history of quantum mechanics, and often had discussions with his friend Baragatti, who, as a physics professor, should have known something on that subject.

One day, after the two had shared some Chianti, Pirelli said: "I have become convinced that many seeds of quantum mechanics can be found in the works of the great Florentine authors. In other words, scientists like Bohr, Einstein, and many others, who were men of broad cultural interests, found inspirations for their ideas and discoveries in the classics. You know there are many TLAs (three-letter-abbreviations) in physics. EPR (Einstein-Podolski-Rosen) and BCS (Bardeen-Cooper-Schrieffer) come to mind. I propose my theory to be known as DPB, or Dante-Petrarca-Boccaccio. What else!"

"Well, do you have some evidence to support your theory?" inquired Baragatti.

"I have preliminary evidence, and I know some of my former students are doing more research. I am confident that with hard work we will uncover more solid evidence, but for the time being I shall give you some examples. Let us start with Bohr, and his **principle of correspondence**. Where do you think he got the idea? Here is what Dante says in Paradise, Canto XXVIII, verse 71:

Dunque costui che tutto quanto rape

l'altro universo seco, ***corrisponde***
al cerchio che più ama e che più sape:

Let's not get into what all that means, but the relation to the **principle of correspondence** seems pretty obvious to me."

"I agree entirely," said Baragatti. "But I am sure you have more."

"Indeed, I do. You would think that Petrarca, with his lyrical poems and his idealized love for Laura, would be a theoretician. Instead, he was also a practical man and a source of inspiration for two of the most important instruments in particle physics. In the Canzoniere, CXXIX, verse 58, he says:

indi i miei danni a misurar con gli occhi
comincio, e 'ntanto lagrimando sfogo
di dolorosa ***nebbia*** *il cor* ***condenso****,*
alor ch'i' miro et penso,

Nebbia, of course, is fog, and it is the condensation of this fog that creates the particle tracks in the **cloud chamber**. And also, in the Canzoniere, XXIV, verse 9, he says:

ma quella ingiuria gia lunge mi sprona
da l'inventrice de le prime olive:
che non ***bolle*** *la polver d'Ethiopia*

Bolle is bubbles, so Petrarca also inspired the more advanced bubble chamber."

"Great," said Baragatti, "but what about Boccaccio?"

"Boccaccio is even better. You have to know that in the Decameron, Boccaccio uses the expression spazio di tempo nine times. Nine times! How can anyone negate that he was really the inspiration, if not the inventor, of the concept of spacetime? My favorite usage of the concept is in the ninth story of the second day. It involves a bet between two merchants to assail the virtue of the wife of one of them. The sentence is so good that I will attempt to provide a translation of it."

(Giovanni Boccaccio, Decameron, Giornata seconda, Novella nona)
E dicoti così, che se io fossi presso a questa tua così
santissima donna, io mi crederrei in brieve
spazio di tempo *recarla a quello che io ho già*
dell'altre recate.

Translation: And I tell you that if I were close to
such a super saintly woman of yours, I believe that
in a short space of time I would lead her
to where I have already led other women.

Baragatti was impressed. The two friends ordered more Chianti and drank to the success of the DPB theory.

The Dream Machine

Don Ciccio Illuminato lived in the basement of a house in a street of the Spanish Quarter (or *Quartieri Spagnoli*) in Naples, Italy. Like most of the people in Naples, and especially the residents of that part of the city, if he were to be asked how he was making a living, he would have answered with the words of Rodolfo in Puccini's Bohème, namely: "How do I live? I live."

Except, unlike Rodolfo, Don Ciccio was not a poet. Instead, he had a passion for science, and had transformed his very modest dwelling into what you could call a mad scientist laboratory. Old surplus equipment from the U.S. Navy, parts of computers obtained from dumps and flea markets, dials and gauges from abandoned locomotives, one third of a traffic light (the red part, unnecessary in Naples), all this and more were connected by cables and occasionally produced flashes of light. In a corner of the room there was a blackboard, on which Don Ciccio wrote a new equation every day, copied from an old book on quantum mechanics.

While all the displays and equipment above did not make any sense, after several years Don Ciccio had acquired in that part of town the reputation of a man of science. This was helped by his appearance, which was that of a skinny man in his sixties, with long white hair and a beard. One day Don Ciccio came up with an idea that would eventually change his life. He gradually let it be known that he had developed a machine that could record the dreams of people while they were sleeping.

The machine consisted of an old computer and an even older tape recorder. The computer had some blinking lights, and the recorder made a reel of tape turn. That was it. The two instruments were connected, and a colorful ribbon cable coming out of the computer was split into several branches whose ends were taped to the head of a willing customer. For a fee, Don Ciccio would attach the "electrodes" to someone's head, turn on the

contraption, and come back in the morning to collect the recording. Naturally there was no such thing, but the customer believed that his dreams during the night had been recorded. After Don Ciccio processed the raw data, the customer would come to his house and watch his dreams on an old TV set. The "dreams" were obtained by piecing together short sections of old movies, which Don Ciccio rented from the equivalent of a local Blockbuster video rental store.

Don Ciccio was a kind man and did not charge much for his services, and his business was limited to the poor area where he was living, and had maintained its modest form for many years. However, it came to the attention of the Camorra, which is the Neapolitan Mafia. You have to know that by now technology had progressed tremendously, and even simple people now owned computers and cell phones. The Camorra bosses hired some smart youngsters and pretty soon they were selling an app and some kind of earphone. People were putting the contraption on their head while connected to their computer, and went to sleep. Overnight, the signals from their dreams were uploaded directly to the internet. After proper processing, the recovered dreams were downloaded to a private storage which the client, if he so wished, could make available to *friends*.

When this idea was first proposed at a reunion of the Camorra bosses, some of them had been skeptical of its possibilities of success. "People will eventually find out that it is a scam," had observed Don Calogero De Boni, a respected boss. But Monsignor Pasqualoni, whose responsibility was the spiritual care of the souls of the district, and who anticipated rewards for his charities, reassured all of them by saying: "Two thousand years of history have taught us that people will believe anything."

As of today, Don Ciccio is not with us anymore, and the business of recording dreams has expanded all over the world. Most people that practice it do not want to let it be known that they do it, so it is a kind of subterranean activity mostly controlled by the mafia. As with other internet activities, hackers have infiltrated it, often with bad consequences, also due to the ruthless control of the business by the mafia. The dreams of respectable family men have been stolen and revealed to jealous wives, resulting in countless divorces or worse. National security organizations have intercepted the dreams of important personalities, including heads of state.

Today many people in Naples think nostalgically of the times when dream recording was the sole business of Don Ciccio Illuminato.

The Charmonium Restaurant

Gilberto was an Italian young man who had fallen in love with quantum mechanics. He had obtained a degree in Physics at the University of Parma and had become an assistant professor specializing in statistical mechanics. He was so in love with quantum theory that his wife was jealous of it. In fact, whenever he would tell her "*Quanto ti amo,*" she was wondering if in fact he meant "*Quanto, Ti amo*." To understand this, you have to know that in Italian quantum is called quanto, and quanto also means much, very much, how much. Quantum and quanta are Latin words, and not even the Church speaks Latin in Italy anymore, therefore we have *quanto* and *quanti*. So, you can see how a single comma (in Italian) can change "How much I love you" into "Quantum, I love you" - and induce jealousy in a woman.

This reminds me of the importance of commas, as seen by the significant change in meaning in the following sentences:

Woman without her man, is nothing.
Woman, without her, man is nothing.

Therefore, you should be very careful with commas, especially when dealing with women, period. And so on, and so on.

To get back to the story of Gilberto, you have to know that one day the grant that was supporting his assistantship came to an end. Maybe there were political reasons, maybe in spite of his love for the subject he was not that brilliant, maybe there were more qualified candidates, we do not know. In any case he found himself out of a job, so he decided to use some money that his family had left him and opened a restaurant in the mountains surrounding Parma (if you object to this and say that there are no mountains around Parma you may as well stop reading this story). I accidentally discovered this restaurant several years ago. It had excellent food, such as is normally found in the area around Parma: the famous prosciutto di Parma, Parmesan cheese, and so on.

What distinguished the restaurant from other trattorias, however, was the style and décor that Gilberto had instilled into it. He was still in love with quantum mechanics, and he had used his favorite subject as a theme for the restaurant. To start with, the name of the place was Charmonium[1], a very unusual name in those days, since the charm quark had not been found yet.

Understandably, the walls of the restaurants were covered with pictures of

famous physicists, mostly Nobel prize winners. As seen in many French restaurants, there was a blackboard, which, instead of showing the daily specials, was updated daily with formulas and equations that Gilberto copied from his old books.

A sign on the wall pointing to the restrooms was labeled SPENT FUEL. When you arrived there, you were faced with an illustration of the famous duality in quantum theory. The ladies' room was labeled "*Onde*" (waves), because *Onda* is feminine in Italian. The men's room was labeled "*Corpuscoli*" (particles), because *Corpuscolo* is masculine in Italian.

Not surprisingly, the quantum mechanical theme extended to the menu. I only recall a few items, such as *bistecca alla Planck*(2) (steak a la plancha), and the *Werner Heisenburger*(3). The fish entrees were listed under *From the sea of Dirac*(4), while the meats where listed under *From de Broglie*(5) (from the broiler). Some patrons probably did not understand the subtle connections, but the Charmonium was not too far from the University of Parma, so some of the visitors appreciated the humor involved.

The undebatable specialty of the restaurant was Potatoes a la Brillouin. The name derives from the fact that the potatoes are cut in the attractive shape of a tridimensional zone very important in solid state physics. Gilberto was gracious enough to give me a copy of his recipe. The ingredients are simple, but the process is relatively complicated, and I must confess that I have tried it only once myself.

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Not long ago I went back to Parma and looked for Gilberto and the Charmonium. Sadly, I could not find either, and although I made inquiries, no one seemed to even remember the existence of them. I suspect that once the novelty wore out, business went down and Gilberto was forced to close. Maybe the good citizens of Parma went back to their preference for solid traditional food. But I am willing to bet that Gilberto, if he is still around, has found a way to insert his love for quantum mechanics in whatever business he may now be involved in.

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(1) Any meson formed from a charm quark and its antiquark.

(2) Max Karl Ernst Ludwig Planck, Nobel Prize in Physics, 1918.

(3) Werner Heisenberg, Nobel Prize in Physics, 1932.

(4) The Dirac Sea is a theoretical model of the vacuum as an infinite sea of particles with negative energy.

(5) Louis Victor Pierre Raymond de Broglie, Nobel Prize in Physics 1929, (pronounced dəˈbrɔɪ in English).

The Maltese Cross

The Sovereign Military Order of Malta, known officially in Italian as the *Sovrano Militare Ordine Ospedalieroxw di San Giovanni di Gerusalemme di Rodi e di Malta*, also commonly known as the Knights of Malta, is a Catholic lay religious order, traditionally known to be of a military, chivalrous, and noble nature. Though it possesses no territory, the order is a sovereign entity of international law, enjoys permanent observer status at the United Nations, and maintains diplomatic relations with many countries. The order continues a tradition started in the eleventh century at the time of the Crusades. The symbol of the order is the Maltese cross.

Maltese Cross at Piazza
dei Cavalieri di Malta

The Maltese cross is prominently displayed at *Piazza dei Cavalieri di Malta* in Rome, where the *Villa del Priorato di Malta* is located. The Villa is a tourist attraction, mostly because of a keyhole. People have long been known to have a strong, although unconfessed, interest in peeping through keyholes, as demonstrated by the long lines at the gate of the Villa that even remain in place during light rain. Some visitors are known to have been tricked into expecting a vision of bathing nymphs, and are disappointed when they only see the dome of Saint Peter's Basilica framed among beautiful trees. Yes, it is a pretty view. But, if you expected to see naked bathing nymphs, it is a disappointment nonetheless.

The attraction of a keyhole at Piazza dei Cavalieri di Malta

View from the keyhole

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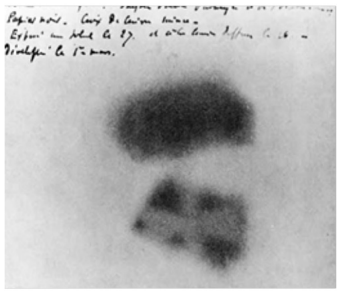
On **March 1, 1896**, in Paris, Henri Becquerel developed a photographic plate which had been in contact with some uranium salt. He was studying fluorescence, and the salt should have become fluorescent due to exposure to the sun. But the sun had not appeared, which was not unusual in Paris in March. Accordingly, there should have been no visible effect. However, when the plate was developed, the shadow of a metal Maltese cross placed between the plate and the uranium salt was clearly visible. Becquerel interpreted the result correctly, performed other experiments, and is credited as the discoverer of radioactivity.



Becquerel's first photographic image of a Maltese cross using radioactivity

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On **March 1, 1896**, Italy sustained a tremendous defeat on her ill-fated campaign to colonize Africa, with a disastrous loss at the battle of Adua, or Adwa, against the Ethiopian forces. The huge number of casualties, about six thousand, generated a wave of protests and large street demonstrations in Italy. The prime minister, Francesco Crispi, was forced to resign. Crispi, who was a Sicilian anticlerical firebrand and a freemason, had started as a socialist, but over time became more and more authoritarian and a promoter of colonialist expansion adventures, a pattern later followed by Mussolini.

Francesco Crispi

*****

Count Rinaldo degli Ossibuoni was an old gentleman whose family had long been part of the so called *aristocrazia nera*, or black aristocracy, that was supportive of the pope and his temporal power. Things had changed since the new kingdom of Italy had invaded Rome in 1870 and had declared the city to be its capital. The pope had locked himself in the Vatican and refused to have relations with the Italian state, a situation that would last for over thirty years.

For many years Count Rinaldo had been a member of the Knights of Malta. Because of his connections to the Vatican, and also because of his illustrious bloodline which could be traced back to the time of the Crusades, he had advanced in importance within the order. He would one day even be considered for the position of “Gran Maestro.” In addition, he was an aficionado of epic poems, and was an ardent admirer of the times

when errant knights went out looking for fame and glory. Had he lived a few centuries before, he could have been another Don Quixote.

So, it is not surprising that, after the defeat at Adua (Adwa), Count Rinaldo degli Ossibuoni was incensed. “That is what you can expect when socialists and freemasons run the government,” he raged. “Can you imagine, losing a battle to a bunch of Abyssinians?! Nothing like this would have happened at the time of Charlemagne, when paladins like Orlando, Rinaldo (his namesake), Bradamante, and so on, would have won the battle single handed.” *Even in the twelfth century things would have been different*, he thought, *because of Gerardo, founder of the Knights Hospitaller order to which the Knights of Malta trace their continuity*. While he was comparing the newspapers’ accounts of the battle of Adua to the siege of Paris as described in the poem *Orlando Furioso*, his valet announced the visit of one of his friends, Cardinal Maffeo Bocconcini.

Cardinal Maffeo knew one of the astronomers at the *Specola Vaticana* (the astronomic observatory that the Pope maintained in order to properly set the dates of Lent and Easter). He had heard from this astronomer that a scientist in Paris had seen a Maltese cross mysteriously appear on a photographic plate during an experiment. The cardinal did not know the details, since he was not scientifically inclined, but that was enough to set off Count Rinaldo.

“That’s it!” he screamed. “A Maltese cross suddenly appearing out of nowhere, and on the same day as our nation suffers a dishonorable defeat. This is clearly a sign of God, calling all the Knights to again defend the Saint Sepulcher!” After profusely thanking Cardinal Maffeo for the information, he wrote a long letter to *Il Secolo* and *La Tribuna* which were the major newspapers at that time. Next, he personally polished the armor and the lance that had belonged to one of his ancestors, and planned to take them to the forthcoming assembly during which the next Gran Maestro of the Order of Malta would be elected.

The newspapers indeed published his letter. Two days later, they also published a letter from Stanislao Adiabati, Professor of Physics at the University of Rome. Professor Adiabati made it clear that the fogging on the photographic plate observed by Becquerel in Paris was due to the uranium salt, not to the Maltese cross per se. Not only that! To Count Rinaldo’s chagrin, Professor Adiabati had repeated the experiment, using - guess what? - a metal charm emblazoned with a square and compasses, which were the symbols of the freemasons. He had obtained a similar

effect.

A few days later, when Count Rinaldo appeared at the Order's assembly with his ancestor's lance and armor prominently displaying the Maltese cross, his fellow Knights chose not to vote for him and elected somebody else to the exalted position of Gran Maestro.

Count Rinaldo degli Ossibuoni spent his last years advocating to all the cardinals he knew that they needed to convince Leone XIII, then the pope, to condemn uranium as a product from the devil. While he did not succeed during his lifetime, today the battle for banning uranium has been taken over by nonproliferation advocates and nuclear energy opponents, all of whom would gladly consider him a forerunner of their objectives.

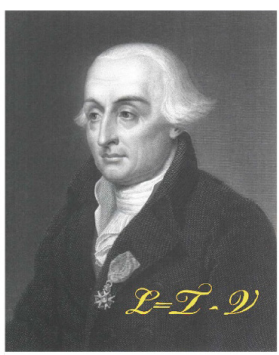
Hamilton versus Lagrange

This story takes place a number of years from now. How many, we do not really know. In any case it is reasonable to expect that there should have been some changes, compared to our time, not only in technological gadgets, but also in the attitudes and interests of the human population. People had not become any nicer; deep down they had maintained a healthy percentage of *sonofabitchism*, but there were differences from today. For one thing, people had become more knowledgeable about visual arts, literature, and science. Accordingly, the interest in sports events had decreased substantially and had been replaced by an enthusiasm for intellectual games that sometimes bordered on the fanatical. Contact sports, such as boxing and American football, had essentially disappeared.

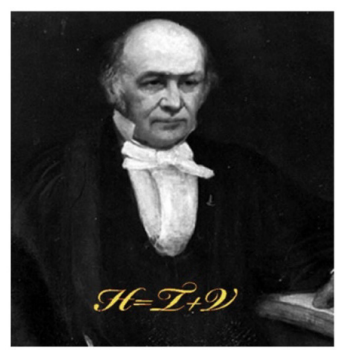
For example, a TV game which had a tremendous following consisted of two contestants engaging in a sort of debate. Each one would take up the defense of a famous scientist, usually from the past, and would use any argument in order to prove his superiority over the adversary. The audience was reacting to the arguments and, by signifying approval, would eventually determine the victor. Although the audience was generally quite sophisticated and appreciative of the discoveries attributed to the scientists, it was visibly more engaged when supposedly negative aspects were brought in, such as the love affair of Madame Curie. In some case the challenge assumed the character of a prizefight and the passion of the public reached feverish levels. The contest between Democritus, who had predicted atoms in ancient Greece, and Ernst Mach (the one of the Mach's

number), who died in 1916 still not believing in the reality of atoms, had been a particularly watched event. In the end Democritus had won.

On this particular night the contestants were an Italian and an Irish physicist. The Italian was supporting the French scientist Joseph-Louis Lagrange while the Irishman was supporting William Rowan Hamilton (not Alexander Hamilton, the one of the musical). Both were famous mathematicians who made great contributions to science. Interestingly, both associated their name to two functions, the Lagrangian and the Hamiltonian. That was at the time of classical mechanics. With the advent of quantum mechanics, the Hamiltonian was hijacked, so to speak; it became an operator, and ruled supreme in the field. Later on, with the introduction of quantum field theory, the Lagrangian formalism came back, and theoreticians today seem to talk mostly in terms of Lagrangian densities. So, there is and there was a kind of rivalry between the two approaches that justified the passion of the fans in opposite camps.



Joseph-Louis
Lagrange
1736 -1813



William Rowan
Hamilton
1805 -1865

The contest began with the two adversaries bringing up formulas and equations according to the opposing viewpoints. “Take that,” screamed the Irishman and raised a sign containing the Hamiltonian of an electron in an electromagnetic field.

$$H = \frac{1}{2m}\left(\vec{p} + \frac{e}{c}\vec{A}\right)^2 + eA_0$$

The audience roared with approval. “Go William!” “Oh yeah?” retorted the Italian, and he flashed the Lagrangian density for an electromagnetic field.

$$\mathcal{L} = -\frac{1}{4}F_{\mu\nu}F_{\mu\nu} + \frac{1}{c}j_\mu A_\mu$$

“Bravo Giuseppe!!!” screamed a spectator. A Frenchman in front of him turned his head: “Giuseppe? Who is Giuseppe?”

Things continued this way for a while, with equations being exchanged more and more violently. At some point, after the Lagrangian density for the Higgs particle had been introduced, the Irishman said: “Even before quantum mechanics, everybody knew that the Hamiltonian function is the kinetic energy **plus** the potential energy. I mean **H=T+V**, which means that our Bill was a positive influence. In contrast, your Lagrangian is **L=T-V**, the kinetic energy **minus** the potential energy, which proves that your Joe was a negative influence.”

The audience was not particularly impressed and felt that the argument was lame. Then the Italian said: “Negative influence indeed! One way to assess the standing of a historical personage, scientist or otherwise, is by observing the respect and consideration that his fellow citizens have for him. Lagrange died in Paris after surviving the French revolution, but, as perhaps is not universally known, was born in Torino as Giuseppe Luigi Lagrangia. And in Torino you find Via Lagrange, which is a very elegant street for pedestrians only, with fancy shops and an aristocratic atmosphere. Your Sir William was born in Dublin and his fellow citizens dedicated to him a Hamilton Street that looks very boring, with rows of apartments and parked cars.

Via Lagrange, Torino

Hamilton Street, Dublin

And one thing more, in Via Lagrange you will find Signorvino, one of the best places in Italy to find excellent wines, grappa, and the like. How negative is that?”

Signorvino,
Via Lagrange 13, Torino

The audience went wild and roared with approval. Joseph-Louis Lagrange was declared the winner.

A Martian Feeling

We know a lot about Mars today. Mars the planet, that is, not the God. Because of the rovers that NASA has sent up there - Spirit, Opportunity, Curiosity - we know that there are no Martians there. However, the image of a Martian as a kind of out of place person has fortunately remained in our perception and language.

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While growing up and even after reaching adulthood, Professor Gianluca Baragatti found himself in situations where he felt that he was being looked at as if he were a Martian. Two of those episodes will be related here. First, we want to point out that, if you are visiting a foreign country, and it is obvious that you are only a visitor there, people will often be very understanding when they realize that you are not familiar with one of their events, traditions, or peculiarities. (For example, if you are in France, and you run into a political activist intent on giving you some toxic rightist leaflets, if you say "*Je suis étranger*," you will elicit the response "*Ah, étranger, d'accord*," and he will stop pestering you. The French must be the most agreeable people in the world, judging by their exorbitant use of the expression *d'accord*. But if you are in your country of birth, and if you speak the language as a native (as in fact you should unless, of course, you moved away at a young age), there is a chance that being ignorant of a

particular very popular instance or event will make you seem like a Martian.

Gianluca Baragatti and his wife Berenice were spending some time in Tuscany. At night they stayed at a simple inn, and during the day they visited different small towns, enjoying art, history, food, and wine, not necessarily in that order. One day they visited Città della Pieve, a delightful small town in the Umbria region. While driving into town Gianluca and Berenice passed by the local carabinieri (police) station, which was a very simple structure. "I feel sorry for those guys," said Gianluca. "It must be boring to enforce the law in a sleepy place like this." After parking the car, they walked all over and absorbed tons of medieval culture. Eventually they decided to have lunch at a nice restaurant. While they were waiting for their *Bistecca alla Fiorentina*, a large group of men and women in uniform entered. They were obviously carabinieri, one of the branches of the Italian police, and they sat down at a very long table that must have been reserved for them. Gianluca and Berenice were sitting at some distance from them but without obstructions, so they were getting a good view of the entire group.

Carabinieri Station in Città della Pieve

What was immediately striking was the appearance of the people in the group. The men were very handsome and the women were extremely beautiful. One of them (the women) had taken off her uniform's jacket, revealing a partially unbuttoned shirt, which adhered harmoniously to well-shaped forms.

"You should try to be more discreet with your looking," said Berenice to Gianluca, "and concentrate on the meat on your plate."

The group finished their lunch. They probably had important police work to

do, and they left the restaurant. Gianluca called over the waiter who had served that table, and who was now picking up the dishes, and asked whether there was some event that had brought such exceptional police presence. The waiter said that those were "the" Carabinieri, and after some misunderstanding, clarified that the people at the table were actually actors. But he looked astonished that someone who was speaking correct Italian was not familiar with a television serial called "Carabinieri."

Frame from Carabinieri serial

Professor Baragatti later learned that the serial had been running for several years and was probably the most popular television show in Italy at the time. In fact, the story was based in Citta' della Pieve. Suddenly, he understood the waiter's surprise and why he had seemed to look at him as if he were a Martian.

*****

It was a Saturday morning. Gianluca Baragatti and Berenice were staying at a hotel near the Forlanini Airport in Milan. The following day they would fly to London and then to the United States. They had returned the rental car, which would have been a nightmare to drive into the city, so they took a cable car to downtown.

When they got off very close to *Piazza del Duomo* they found themselves in the middle of a huge crowd. Gianluca had no idea what this was all about. People could hardly move, bands were playing national anthems, and a giant stage had been set up on a side of the square. Gianluca asked someone about the nature of the event. It was, of course, the final ceremony of the Champions League which was taking place in Milan. The what? Gianluca suspected that it was related to soccer, but since he was not sure he had to ask. "Si, calcio, signore!" By the expressions on their faces, the people around Professor Baragatti must have wondered whether he was a

Martian.

Final ceremony of Champions League in Milan

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Later on, Professor Baragatti mused that probably there must have been many more instances in his life during which people looked at him like he was a Martian. The main difference, in those cases, was that he had not even realized it.

An Old Tale Revisited

This story takes place in a fictional town in Northern Italy. The town (and the surrounding region) are world famous for the high quality of their alimentary products, especially hard cheeses and cured hams. But the town also has a rich cultural history, with music (especially opera), being an important part of its vibrant artistic life. And the town also has an excellent university.

Augusto Scorzi had been a professor of physics at that university. After an honorable career that spanned several decades, Professor Scorzi had retired from his position as Chairman of the Department of Physics. In his retirement he began to play the clarinet and even participated in public performances as a member of a municipal band.

One day, something terrible happened to the town. Really terrible, I mean something of biblical proportions. A swarm of insects – some kind of locust variant – suddenly materialized and, since they liked what the town had to offer, decided to take up residence there. We do not blame them. There were two varieties of the bugs. One started chewing on the large cheese wheels stored in the warehouses, while the other preferred attacking

the hams while they were hanging to cure. Obviously, the economy of the town took a dip.

“Can you do something about it?” Professor Scorzi’s wife asked her husband. “Honey, I am not an expert on pest control,” replied Augusto. But then, he thought: “I know physics, and physics is a powerful tool.” So, he started thinking hard and realized that his newly acquired musical ability might be useful.

Professor Scorzi used his physics-based knowledge of acoustics to create new sounds that would blow up the insects. Differential equations describe vibrations of chords and membranes, so Professor Scorzi put these to work. He realized that acoustics would be an essential tool in the war against the insects and started from the fundamental equation of the vibrating membrane, which has some relationship to the d’Alembert equation for the vibrating chord:

$$\frac{\partial^2 z}{\partial x^2} + \frac{\partial^2 z}{\partial y^2} = \frac{\rho}{\tau}\frac{\partial^2 z}{\partial t^2}$$

He probably also used his knowledge of the dynamics of a linear chain of atoms, both in the classical and quantum approach. After the theoretical approach he moved on to an experimental activity that unfortunately resulted in the demise of some of his neighbors, but that had to be accepted as collateral damage. Finally, when his tests appeared to be successful, he contacted the mayor. If he managed to liberate the town from the insects, he expected to receive a reward. But he did not want money, he just hoped for a statue in his honor, holding the clarinet.

The mayor agreed, and Augusto went outside and started playing his clarinet. Gradually, all the bugs started dropping dead, because their ears were blowing up. Over the course of a week, the export of cheeses and cured hams was resumed. Augusto contacted the mayor to schedule a session during which he could sit for the sculptor creating the statue. Unfortunately, at this exact time some “experts” came in saying that maybe, just maybe, the end of the bugs was likely due to natural causes. The archbishop was even more direct, and said that his special prayers to the Madonna del Culatello, a sanctuary nearby, were responsible for the end of the infestation.

Augusto was disappointed, so he modified his instrument. When he started playing, all the young and pretty women in the town left their homes and

followed him to a farm a few miles away. The standoff lasted several days, until all the men in the town started protesting. They pressured the authorities and threatened revolution unless Professor Scorzi got what was due to him. The mayor and the city council were forced to modify their position, and quickly developed a plan to finance the statue. The young pretty women returned to the town, and everybody lived happily ever after.

And that is why, if you visit that fictional town today, you can see a statue of Professor Augusto Scorzi playing his instrument.

Of Beauty and Bicycles

The Po River is arguably the most influential river in Italy. Not only because of its size and length, and its importance for agriculture, but also because of the historical and cultural heritage associated with it. And, we might add, because of its legends, which include all kinds of mythical creatures, mostly malefic, which supposedly come out of the heavy fog that is very common in the surrounding region.

This story takes place in a fictional town which is world famous for the high quality of its alimentary products, especially hard cheeses and cured hams. The town is also famous for its contribution to music (especially opera), and for its university. The town is about twenty miles away from the Po River, so most of the times the malefic river creatures stay away from it, but not always.

Professor GianClemente Chianti had retired from the local university's Department of Physics. In his retirement he enjoyed listening to music and working on solutions to paradoxes in physics, especially regarding electromagnetism. He also found pleasure in taking rides around the region on his bicycle, which he had upgraded by adding a number of modern features, such as air conditioning and artificial intelligence. Professor

Chianti was a well-known and well-respected figure in the town.

Another interesting character in the town was Adelina. She was a sexy and bubbly young woman to whom many young men had been aspiring. But Adelina had kept all her suitors waiting, since she somehow wanted something better. Adelina lived in the outskirts of the town and every day she would ride her bicycle to her work.

One day, while she was riding her bicycle, Adelina heard a song coming out of the bushes along the road.

Ma dove vai, bellezza in bicicletta,
But where are you going, beauty on a bicycle,

Cosí di fretta, pedalando con ardor...
In such a haste, pedaling with ardor...

Since no person was visible, Adelina stopped the bicycle and went to investigate. There, she saw the most beautiful little frog who was apparently the one singing the melody. “Aha,” thought the young woman, “Clearly a prince. I will not let this opportunity escape me.” So, she picked up the little lovable creature and, following what every manual instructs you to do in such circumstances, kissed it.

Unfortunately for Adelina and for the entire town, the frog was only an impersonation of one of the malefic creatures who had found his way to the town from the Po River. Immediately, the frog (or whatever it was) entered Adelina’s body and strange things started to happen. Adelina’s outside appearance did not change, but she was now a different person. Over just a few weeks, she was elected to the city council, then became the mayor, and eventually was able to take absolute, and I mean absolute, control of the town.

With her new status, she insisted on being called Princess Pixel-Dot. Since her beauty had not changed, many young men still wanted to marry her, but in order to do that, they had to solve a riddle, which went something like this:

What is that thing that when moving stands up and, when not moving, falls? The silly young men who attempted the test did not know the answer (a bicycle, of course). Because of their failure, they were instantly transformed into pigs, to be fattened and eventually transformed into cured hams. The ham industry was now under the full control of Adelina (I mean Princess Pixel-Dot).

This was the dire situation of the town when Professor GianClemente Chianti decided to intervene and use his knowledge of physics to bring an end to the madness. He first developed a theory for the electro-acoustic field. The main equation of such a field has the covariant form

$$\partial_\mu \boldsymbol{F}^{\mu\upsilon} = \boldsymbol{J}^{\upsilon}$$

where **F** is the electro-acoustic tensor and **J** is a multi-dimensional vector which includes the flow of malevolent noise. After developing the theory, Professor Chianti modified his most powerful amplifiers and speakers according to the theoretical results.

Pixel-Dot had not given up her habit of riding her bicycle and every day she went around the town to inspect her cured ham factories. Professor Chianti set up his amplifiers and speakers in an area where the Princess was due to pass. When she arrived, he blasted the same old song, except – and this is very important - **with a 180 degrees phase change**. Suddenly the lyrics hit the air with a sound that was heard all over the town:

Ma dove vai, bellezza in bicicletta...

Princess Pixel-Dot instantly turned into Adelina again. The malefic creature was thrust out of her body and raced back to the Po River, never to be heard of again, at least in the town. The young men who had been turned into pigs reacquired their human form and eventually Adelina married one of them.

Professor Chianti continued his peaceful life, enjoying his multiple activities, but the town was very grateful to him and erected a statue in his honor. And that is why, if you visit that fictional town today, you can see a statue of Professor GianClemente Chianti riding his favorite bicycle.

TERZA GIORNATA (THIRD DAY)
STORIES CONNECTED WITH BRAZIL

The stories narrated during this day have something to do with the country of Brazil. When people think of Brazil they may have an image of a tropical paradise, which is partially true, but Brazil is also an important country in many fields, including physics. Did you know that the pi meson was discovered by the Brazilian physicist Cesar Lattes? If not, you know it now! Hopefully, these stories will convey a sense of the inherent sensuality of a tropical country and will abide, at a minimum, to geographical truth, without which no moral purpose could even be claimed. And of course, just like the other stories, they contribute to the unity of the book by having a connection, direct or indirect, to some aspects of the world of physics.

A transubstantiation at a research institute cafeteria. A physicist suspected of passing secrets to a hostile power. Taking the wrong bus leads to an interpretation of Dante's verses. The consequences of mistaking the door of a bathroom. Searching for traditions brought by immigrants from the old to the new world. These and other stories are narrated during this day.

Read, Think, Analyze

Professor Gianluca Baragatti was in Brazil, spending a year at the University of São Paulo. He had not yet met Berenice but was getting increasingly concerned about his ability to resist the charm of Brazilian women.

A friend of his, Professor Eric Crabson, was going to spend a month in Argentina as part of a program to bring technology know-how to the Southern hemisphere. The trip and other arrangements were partially paid by the same international organization that was sponsoring Baragatti on his Brazilian sabbatical.

Apart from his specific technology specialization, Professor Crabson was a man quite inclined toward methodology. He thought that any problem should be confronted with a methodical and well-planned approach. When it came to learning, his motto was READ, THINK, ANALYZE. In fact, at the beginning of every lecture he used to remind his students of those three

important steps. So much so that some of his students had started to refer to him as RTA. At the time of the events described here there was no Internet, but we can be assured that, had there been one, Professor Crabson would have been supercritical of people, especially politicians, who would use social media in a knee-jerk reaction fashion, without thinking, analyzing, and so on.

Well, Professor Crabson had decided that on his trip to Argentina he could stop in Brazil and visit his friend Gianluca. Baragatti was delighted, and also arranged for his friend to give an informal talk on his work at the university. The guy who organized seminars in the department of physics was happy to have a distinguished scientist from the North giving a presentation, and only asked Gianluca for a brief written introduction. Gianluca complied, and even mentioned the dedication of Professor Crabson to the reading, thinking, and analyzing approach in his teaching and learning.

The morning when Professor Crabson was supposed to give his talk, both he and Baragatti did not arrive on time. For one thing they had stayed out very late the night before, because Gianluca wanted to show his friend the São Paulo entertainment scenery. But the main culprit was the insane traffic of a megalopolis of eighteen million people, which engulfed and often totally blocked the taxi in which the two gentlemen were riding.

At the university, staff and students were waiting in a lecture room, wondering about the delay. Gianluca and his friend hurried, but, before anything else, Professor Crabson had to take care of a very urgent business and was quickly pointed to a nearby restroom. Well, evidently the need was quite compelling, because, in total contradiction of his philosophy, he did not take time to read, think, analyze. He saw a poorly written sign saying HOMEM, on a door, interpreted that as being WOMEN, and did a crash landing through the adjacent door, which had a sign saying MULHER. Crash landing is the right expression, as we will soon explain, because at the same time as Crabson was pushing hard on the door, Maria do Carmo Gonçalves Lima de Almeida (Brazilians tend to have long names) was pulling hard on the door to get out.

Maria do Carmo was arguably the sexiest woman in the department, maybe in the entire university. She descended from Black, Indian, and Portuguese ancestors, all of whom seemed to have left in her their best characteristics. Long hair, green eyes, and above all a perfect figure. She was a secretary - pardon, administrative assistant - to the Chairman of the department, who was expected to be appointed to a higher position in government. All the faculty members, the men that is, secretly hoped that Maria would stay behind.

Maria do Carmo was also known to be religious, and Laercio Mascarenhas, who was the most irreverent student in the department of physics and maybe in the entire university, had once told a story. He had been in a church and had seen Maria do Carmo in a line of faithful people waiting for communion. Laercio, who had quite sensitive ears, had distinctly heard the word of the priest before and after providing Maria do Carmo with the sacramental bread: "…the body of Christ … the body of Christ… Christ, what a body … the body of Christ…the body of Christ …" Actually, nobody believed this story, because Laercio Mascarenhas had never set foot in a church.

In any case, the dynamics and kinematics of the encounter was such that Maria do Carmo fell backward while Professor Crabson was propelled forward. The woman let out a big scream, with the result that staff and students came running from the nearby conference room. They were flabbergasted at the sight of Professor Crabson on top of Maria do Carmo, who had lost some of the light top she was wearing. Both had scratched themselves in the fall. It took a while to clarify what had happened. The talk was canceled, Professor Crabson was in terrible shape, and he also was suspecting that some people did not actually believe his (and Maria do Carmo's) version of the event. Laercio Mascarenhas was heard saying: "These gringos, they act as if they never saw a woman." And he was trying to find words starting with R, T, and A which could describe an alternative reality.

Luckily in those days there were no social media, otherwise there would have been a repercussion worldwide. Of the two, Maria do Carmo was the one to recover first, and she felt sorry for Professor Crabson. As she told her friends later: “He was not even bad looking. I wish I had met him under better circumstances.”

Professor Crabson went back to the United States. As the new academic year was due to start, his assistant asked him if he was going to start his lecture with his customary appeal to read, think, analyze. Crabson gave him a long, penetrating look, and said: “Oh, shut up!”

Transmutations

Many centuries ago, alchemists were trying to find a way to transform lead into gold. Lead was considered to be a vile metal while gold was, of course, a noble metal. So, in addition to looking for monetary advantages, there was also a desire to improve the quality of things, something comparable to the spiritual trip contemplated by various religions and the like.

It was only in the twentieth century that transmutation of elements became a reality. Yes, it is in fact possible to transform lead into gold. Several nuclear reactions are feasible, starting from different elements. For example, from a stable isotope of mercury (Hg) to a stable isotope of gold (Au):

$$^{198}\mathbf{Hg}+\gamma \rightarrow {}^{197}\mathbf{Hg}+\mathbf{n}$$
$$^{197}\mathbf{Hg} \rightarrow {}^{197}\mathbf{Au}+\mathbf{e}^{+}$$

Of course, to accomplish this, you need accelerators, or nuclear reactors, or expensive shit like that. And the cost involved would be much higher than whatever you could get by selling the gold.

Professor Gianluca Baragatti and his friend Massimo Pirelli were having a conversation about transmutations. “Enough with physics,” said Baragatti, “but I am sure that you are aware that there are other kinds of transmutations. For example, every day, on this planet, masses are held, and bread and wine are routinely transmuted into the flesh and blood of Jesus Christ.”

“That is actually called transubstantiation,” said Pirelli, “and I am sure you do not believe in it.”

“You are wrong there. I do firmly believe in it.”

“I do not believe you believe it,” insisted Pirelli. “You are a declared unbeliever, a *miscredente*, a *Miss-credente*, we already went through all that.” “As a matter of fact, I believe in transubstantiation because I have seen it happen in front of my eyes, many times,” said Gianluca. And he proceeded to relate the following story.

“Several years ago, I was working in Brazil, at a nuclear engineering institute which was located at the University of Rio de Janeiro. The institute had a cafeteria that provided lunch for the workers, and the food served was, not surprisingly, Brazilian food. Now, the main staple in Brazil is rice, served with a mixture of black beans that have been cooked with pork components. In fact, the best-known Brazilian dish is probably the feijoada, a concoction of black beans into which all parts of a pig - feet, ears, tail, etc. - have been dropped and simmered for a long time. While what is more commonly put on rice is not a feijoada, we can safely say that rice, beans and pork are part of the daily diet of the Brazilian people, like pasta in Italy, and potatoes in Sweden.”

“Now, at the Institute there was a scientist and nuclear engineer who was visiting from Pakistan. I forgot his name, so I will call him Khan, since Khan is a common name in Pakistan. And, just to be safe, if his real name was in fact Khan, I could always say that the character in this story was a different Khan. In any case Khan was a Muslim, and accordingly he would not eat pork.”

“I noticed that, when we went to lunch together and were in line at the counter, that Khan would point to the black beans stew and ask the young lady who was serving: “Senhorita, bife?” To which, the young lady invariably replied: “Sim senhor, bife,” and proceeded to scoop up a generous portion of said stew and place it next to his rice. And that is where I had a direct experience of the transubstantiation of pork into beef.”

“One day, there was a change of personnel in the cafeteria. There was a new young lady behind the counter who was even better looking than the previous one. When she was asked “Senhorita, bife?” she looked surprised and answered: “Não, senhor, porco.” At that point Khan refused the bean stew. The manager of the cafeteria, who had noticed what was taking place, came over and profusely apologized for the external events that had prevented, just for that particular day, bovine meat from reaching the kitchen.”

The following day, while the sun was busy carpet bombing with photons the beaches and the buildings of Rio de Janeiro, under the benevolent gaze of the statue of Christ the Redeemer, when Khan asked his usual question: "Senhorita, bife?" the answer from the new server was "Sim, bife!" And that is how I had more occasions of directly observing more instances of transmutation, or as you call it, tran-substantiation."

Professor Baragatti's wife, Berenice, had been listening to the last part of the story. "Massimo," she said, "do not believe my husband. The only true part of the story is that about Brazilian food. Matter of fact, I am planning to make a feijoada and invite a few friends over. We will also have a churrasco, which includes lots of beef. And everything will be up front, so that there will be no need for transmutations or transubstantiations."

On English Pronunciation

A phonetic language is one in which the written form is very close to the spoken form. English is not a phonetic language, and the same group of letters in different words often have different pronunciation. This makes it more difficult for foreign speakers to learn the language and speak properly. Even Enrico Fermi initially could not pronounce words correctly. The following is an excerpt from Abraham Pais' "Inward Bound," a book that covers the history of modern physics.

In 1930 Fermi gave some lectures on quantum electrodynamics at a seminar in Ann Arbor, Michigan. "*According to Uhlenbeck(*), Fermi had prepared himself for lecturing in English by taking a course at a Berlitz school in Rome, thus acquiring fluency which, however, was not quite accent-free. 'Finite' became 'feeneetay.' When a listener asked about something being infinite Fermi did not understand and Uhlenbeck had to explain. 'Ah,' Fermi smiled, 'infeeneetay.'*"

Professor Gianluca Baragatti also had a problem with words that he knew how to spell, because he had encountered them in books, as written words, but had actually never heard pronounced. One such word was *brothel*, which he thought would be pronounced **/ˈbrəthəl/**, like in "brother." Instead, he accidentally learned from a lady, during a political discussion which involved a few knowledgeable individuals, that the correct pronunciation of the word is **/ˈbräthəl/,** which to him sounded more like the capital of Belgium, as in "Brussels sprouts." Note that the sounds of the

phonetic symbols **th** and **th** are quite different. And, when Professor Baragatti was in Brazil, working at the Institute of Nuclear Engineering in Rio de Janeiro, he also realized that some people mispronounced English words that they knew how to spell. Once, after he had told a joke that implied a vulgar English word, a lady that had recognized the word said: "Ah, **/fo͝ok/**," pronouncing the letter u as in "put" (**/po͝ot/**). Gianluca pointed out that the correct pronunciation was **/fək/**, like in "buck," thus making a tiny educational contribution. Some male colleagues at the Institute noted that there were also women who knew how to pronounce the word, although they did not know how to spell it, but Professor Baragatti never met one of those. Speaking of Brazil, the letter w comes to mind. In some instances, it is pronounced like in the United States. For example, it is not uncommon to find people with first names like Washington (Uoshinton) or Wellington (Uellinton). But other times the letter w sounds like in German, as in Wagner (Vagner). In those days (1972, to be more precise) construction had begun in the state of Rio de Janeiro on a PWR (Pressurized Water Reactor) manufactured by Westinghouse. One day in the cafeteria, while making small talk, the director of the Institute insisted that he had heard some people referring to that company as Vestinguss, although that seemed farfetched.

What we have described up to now took place about fifty years ago. In Brazil today the knowledge of English is much more widespread than it was in those times. This is particularly so amongst young people, and also because of the influence of computers, cell phones, the internet, social media, and horrible things like that. It is therefore less likely that mispronunciation of words will occur. However, as the following true story will prove, misinterpretations can still take place.

Walter (Valter) was a young Brazilian man from a middle- class family. He studied social sciences at the University, lived in Leblon, a sophisticated district of Rio de Janeiro just south of Ipanema and Copacabana, played the guitar, and was a consumer of social media. He also had a girlfriend, Wilma (Vilma), who worked as a receptionist, lived in a slightly less well-off area of the city, and was going to night school to improve her education. Occasionally Walter (Valter) would help Wilma (Vilma) with her pronunciation in English.

Eventually the movie Black Panther (Pantera Negra) starring Chadwick Boseman was released in Brazil and unleashed a fan movement among young people. Apparently, the movie deals with a fictional country named

Wakanda, and the phrase “Wakanda forever” became a slogan, to be exhibited on tee shirts and even tiny bikinis on the beaches of Rio.

Obviously, Walter (Valter) became immediately familiar with the “Wakanda forever” phrase. The problem was that at that particular time his wi-fi was not working (a tragedy), and he was not able to hear the sound, he only saw the phrase written. So, when he joined his girlfriend at the Garota de Ipanema bar and wanted to show off, he greeted her with: “Wakanda forever!!!”

The Garota de Ipanema bar
in Rio de Janeiro

Unfortunately, and also because he had a slight pronunciation defect which caused an occasional light stuttering, the first part of his address came off as “Vaca, anda,” which in the local language can easily be interpreted as “Go, cow.”

Wilma (Vilma) had a short temper and, as any self-respecting South American woman would do, unleashed a torrent of invectives that left her boyfriend speechless. The situation could easily have not ended well, except for their common friend Wilson (Uilson), who explained the misunderstanding and defused the situation. As far as we know, Walter (Valter) and Wilma (Vilma) maintained their relationship and continued improving their pronunciation of English words.

(*) George Uhlenbeck and Samuel Goudsmit, both Dutch physicists, discovered the spin of the electron in 1925. Uhlenbeck was one of the organizers of the seminars in Ann Arbor. He knew Fermi well because he had earlier spent some years in Rome as a private teacher to the son of the

Dutch ambassador.

Defection

Bruno Pontecorvo was a prominent Italian physicist who worked with Enrico Fermi in the early days of neutron reaction studies. After the end of World War Two he worked in Canada and in England. He suddenly disappeared in 1950 and he turned up later in the Soviet Union. The first years of the 1950s were characterized in the United States by extreme paranoia about communism and spying. The defection of Pontecorvo, at the height of the Cold War, contributed to the escalation of suspicion in an era which included McCarthyism and the execution of Julius and Ethel Rosenberg. The following story takes place sometime in the middle of the first half of the 1950 decade.

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Pierclaudio Filippi was an Italian physicist who was increasingly becoming well known because of his discoveries in the high energy particles field. He had received offers of employment from prominent American universities (Columbia, Berkeley), as well as national laboratories (Oak Ridge, Los Alamos, Argonne). He had not yet made up his mind about these opportunities and was presently attending an international meeting in Rio de Janeiro, Brazil.

Unknown to Pierclaudio, his growing notoriety had also come to the attention of the Central Intelligence Agency. “We should keep an eye on him,” said the bosses at headquarters. “We do not want him to disappear like that other one, Pontecorvo. Our informers tell us that these men knew each other, and they may also have had similar political ideas.”

That is why Anthony Pasquali, the CIA man at the American Consulate in São Paulo, had been handed a top-secret cable instructing him to set up a discreet surveillance operation around the Italian scientist during his stay in Brazil. The cable instructions were to look for signs of *potential defecation*, which initially caused some consternation, until it was clear that this was a typo for *potential defection*. Further communications also made clear that Pasquali, who had been born in Brooklyn and spoke fluent Italian (well, maybe fluent Sicilian), was the best man for the operation.

But destiny had other plans. A few days preceding Pierclaudio Filippi’s

arrival in Brazil, Anthony Pasquali went with his current Brazilian girlfriend to a club where they were rehearsing for Carnaval. Maybe he drank a little too much. Anthony tried to duplicate some steps of the *capoeira* dancers but failed miserably, ending with a fall and a leg fracture. So, instead of a secret operation, he was involved in a surgical operation. The surveillance job was handed by default to Keith McBratt, who, besides not having any knowledge of the Italian (or Sicilian) language, was not the smartest member of the American intelligence community in Brazil.

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This explains why Keith McBratt, who had bribed the hotel clerk to get the room adjacent to that of Professor Filippi, was now using a secret device to listen through the wall separating the two rooms. He could easily make out that there were two people in the other room, but he could not understand a single word. Pierclaudio was very interested in learning about the culture of the country he was in, especially music. He had gone earlier to a sort of nightclub known in Brazil by the name of *boate*, which is a deformation of the French word boîte, or boîte de nuit. He had struck up a conversation with a very nice and intelligent young woman, who was also interested in physical science. They (the scientist and the young woman) were now continuing their conversation in the hotel room, to the despair of the CIA agent who could not even figure out the spelling of the words, let alone understand their meaning.

With the exception of one key moment. Maybe because other noises had diminished, or because the secret listening device suddenly functioned, Keith McBratt distinctly heard the man in the other room say the following sentence:

Io russo

Keith immediately went to his pocket Italian to English dictionary (he was very proud of having brought it along) and quickly translated:

I Russian

“Aha,” he thought, “I have got it. The guy is not even Italian, he is Russian. Either he has misled everybody all the time, or the person here is someone else, to put us on the wrong track. This is the most probable case, since real scientists do not go to nightclubs, they stay home doing calculations. Either way this discovery should get me a promotion.”

Keith McBratt did not get any sleep that night, mainly because of the heavy

snoring coming from the next room. But the following morning, as the sun was getting out of the water after his morning swim at Copacabana beach, he got in touch with his superiors and made a full report. The man in the other room had personally admitted that he was Russian. "The two in that room." he said, "were playing a kind of 'Me Tarzan, you Jane' game, modified to 'Io russo, tu brasiliana.' Or 'I Russian, you Brazilian.'" He had actually not heard the second part, but he figured that it made sense and explained the entire thing.

McBratt's superiors took the report seriously. In those days the gringos had a huge influence on the Brazilian government. This is illustrated by a famous picture (actually taken about five years after our story) that shows Brazilian President Juscelino Kubitschek asking for money from then United States Secretary of State John Foster Dulles. At least, that is one way the picture was interpreted. Thus, it was not surprising that the Brazilian police were easily convinced to pick up Pierclaudio Filippi for fraud, impersonating a scientist, and having a false passport.

This photograph, showing Brazilian President Kubitschek in front of John Foster Dulles, Secretary of States of the United States, was taken in 1958 and published in the newspaper Jornal do Brasil with the title 'Give me some money.' It got Kubitschek so mad that he threatened the paper with national security action.

However, when all the evidence was brought together, and someone proficient in Italian was found (which, by the way, is very easy to do in Brazil), it appeared that the sentence in Italian could have been

alternatively and more logically translated as:

I snore

to which the young woman had probably added: "*Eu ronco tambem,*" or "I snore too."

This fully explained the sleepless night of keith McBratt. The incident ended there and the CIA, which is used to secrecy, did not publicize it. McBratt did not get a promotion, but his boss, who was Catholic and had a sense of humor, absolved him after hearing his confession and giving him a penance of writing "Io russo = I snore" fifty times. Anthony Pasquali recovered from his fracture, left the CIA, and went back to Brooklyn to do more serious work. Professor Pierclaudio Filippi initiated a scientific program with the University of Rio de Janeiro, and went back to Brazil several times, keeping up an intelligent relationship with the young woman who did not mind his snoring.

Projection Operators

This story deals with the danger of interpreting mathematical and physical principles in terms of social features, such as creating metaphors and the like. While this may be fun and, in some cases, may even help in the comprehension of the subject, doing this in a religious or military-dominated environment might actually be dangerous to your health.

Emerson Araujo Gonçalves de Ribeiro Franco was an assistant professor of physics at the University of Rio de Janeiro. Two things will be noted here. First, Brazilians tend to have a long sequence of names. Second, first names ending in -son, like Nelson, Mailson, Edilson etc., are very popular in Brazil. Such popularity does not seem to be explained by past immigration from Nordic countries, where such names are typical. It is doubtful that Scandinavian ancestors would have something to do, for example, with the name of the famous soccer star Pelé, whose real name is Edson Arantes do Nascimento.

End of the digression. Let us get back to Professor Emerson and 1971, which is the year during which this story takes place. You have to know that in 1971 Brazil was under a military dictatorship, and repressive actions and abuses were committed in the name of national security. General Emilio Garrastazu Médici was the President. While he cultivated a

benevolent image, he gave free rein to the secret security services. This resulted in arbitrary prison, torture, and disappearance of dissidents, a pattern that was repeated and amplified during the 70s in Argentina, Uruguay, and Chile.

One of the things that Emerson was good at was associating metaphors with physics principles, laws, etc. He would look at an equation and make weird associations to life, history, politics. He also liked to use equations in a funny way to get odd results. For example, he once combined the two famous modern physics equations $E=mc^2$ and $E=h\nu=h/T$ (c and h being Planck constant and the speed of light) to obtain his period T from his mass m of 65 kilograms. He then went on to explain the procedure to his colleague Clarice Silveira das Boas Costas and told her that his period was $1.1x10^{-52}$ seconds. And then he inquired about her period, for which he got promptly slapped.

One day, while teaching quantum mechanics and using Dirac's book, he put the following equation on the board:

$$\sum_i |P_i\rangle\langle P_i| = 1$$

for which we provide the following very incomplete and most unsatisfactory explanation. A state vector $|P\rangle$ can be expressed in terms of base vectors $|P_i\rangle$. The quantity $|P_i\rangle\langle P_i|$ is a projection operator which, when applied to $|P\rangle$, gives you its component $|P_i\rangle$. The equation above states that the sum of all projection operators is equal to the unity or identity operator.

Now, one could say that the process above is somewhat similar to taking a system, say an engine, apart into all its components, and then reassembling it. You would get the engine back, right? While this is a kind of an illustrative metaphor that may help in appreciating the equation above, that is not what Emerson used to get his point across. He looked at the equation again (and so do you, sorry about that) and said:

$$\sum_i |P_i\rangle\langle P_i| = 1$$

"When our brothers the computer scientists use logical operators, the result of the operation is 0 for false and 1 for true. Thus, the right side of the equation above represents the truth. Now, a projection operator can be seen

as something that projects reality according to a point of view. Accordingly, I claim that the deep meaning of the equation above is as follows:"

"In order to get the truth, one has to consider and add up all points of view. This means that one has to consider the opinions coming from the right as well as those coming from the left. If you were in France this would mean reading Le Figaro, Le Monde, La Croix, L'Humanité, Libération.…"

"If you were in Italy, reading Repubblica, Il Sole 24 Ore, Corriere della Sera, L'Unità…."

"How about L'Osservatore Romano, which is the official newspaper of the Vatican?" asked Anderson Bernardes de Amorim Garção. He was one of the smartest students, but also very religious and very conservative.

"Yes, that too, although I am afraid that its contribution to the truth will be small…" answered Emerson, who had never entered a church in his life.

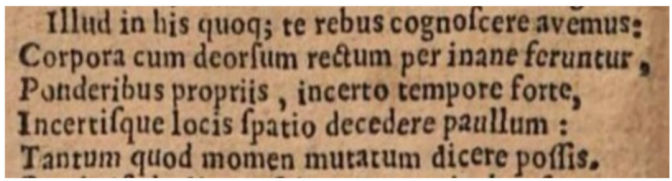
Anderson did not particularly like the response, since he thought that the Truth was to be found principally in religion and that Emerson was deliberately making fun of his faith. He later related to his friends the essence of Emerson's comments, including the opinion that the truth could be found in communist newspapers. And this eventually came to the ears of Wilson Pereira das Armas, a retired Army colonel who was in charge of security at the University.

Some days later Emerson was summoned to the DOPS (Departamento de Ordem Política e Social), a police section that was thankfully dismantled after Brazil's return to democracy. He was lucky that Kleberson Monteiro das Flores, who was the worst apple in that organization and was later indicted for several crimes, was not around. He was instead interrogated by Ericson da Nobrega Araujo do Carmo, an officer who maintained the liaison with the military information services.

"This time we will let you go," said Captain Ericson, "but be careful with your metaphors. I have seen the book by Dirac, where it mentions creation operators. You could compare those things to the actions of our President, which create jobs and prosperity for the people of our great country. But do not go and make up stories about the annihilation operators. Sadly, the disappearance of people is a serious business and anyone who makes fun of it, with metaphors or whatever, should receive sensitivity training."

Recollections of Professor Baragatti

The *De Rerum Natura* (On the nature of things) is a poem in Latin by the Roman poet Titus Lucretius Carus (known as Lucretius). It describes much of science as it was known at the time, about 100 years before Christ, and it contains amazing visionary ideas. Consider the following piece and its translation:


Illud in his quoq; te rebus cognoſcere avemus:
Corpora cum deorſum rectum per inane feruntur,
Ponderibus propriis, incerto tempore forte,
Incertiſque locis ſpatio decedere paullum:
Tantum quod momen mutatum dicere poſſis.

When atoms move straight down through the void by their own weight, they deflect a bit in space at a quite uncertain time and in uncertain places.

Okay, whoever translated *corpora* (bodies) as atoms stretched it a little bit. However, the rest of the text, which describes the epicurean science concepts, heavily based on atomism, justifies it. In any event, it is hard not to recognize the anticipation of the uncertainty principle. But enough of the physics.

The De Rerum Natura also contains a famous verse that says:

Tantum religio potuit suadere malorum,

which has been translated as

So many evils have been induced by religion.

The verse above came to Professor Gianluca Baragatti's mind while he was watching the television screen in horror. People ran along a huge airplane on the runway at the airport in Kabul, Afghanistan, some of them even climbing onto the wheel supports. He had never been in such a situation, and could not imagine the level of desperation that would conduct one to such behavior.

Professor Baragatti's thoughts continued to turn. It appeared that the main plight of the people was to be able to get away and in order to do so one needed an SIV (special immigrant visa). Gianluca Baragatti was reminded

of his own experience with visas.

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Gianluca Baragatti had come to the United States because of a wave of technology demand. After the Soviet Union put a satellite into orbit, America was eager to regain the advantage in the space race and therefore made it easier for anyone with technical expertise to immigrate. Thus, Gianluca came to the US with a priority visa to work in the nuclear industry. After riding on this wave of humanity, the challenge became staying on the crest of the wave, just like in surfing. After a few years things had changed substantially and Professor Baragatti noticed another wave of humanity, smaller maybe, but attractive nonetheless, going in the southern direction. The military government that had taken control of Brazil in 1964 was advertising an economic miracle (it would go poof a few years later) and was promoting advances in science and technology. So, Gianluca, through the Organization of American States and the International Atomic Energy Agency, got an assignment in São Paulo. Before taking the trip, he was advised to get a visa, so he went to the Brazilian Consulate in Los Angeles, where he met with a consular officer.

Now, you have to know that in Brazil, especially in Rio de Janeiro, the letter 't' often has a hard pronunciation. It sounds like 'tch,' as in the word 'church.' For example, one will hear words pronounced as '*restaurantche*', '*diferentche*.' Taking into account that Gianluca's hearing had never been that great, the following is a recap of the conversation that took place at the Consulate (at least the way it was perceived by Professor Baragatti):

Consular Officer - You are going to Brazil to *tcheat*, right?

Baragatti - Excuse me?

Consular Officer - I said, you are going to Brazil to *tcheat*?

Baragatti - ????

Consular Officer (becoming visibly impatient) - You are going to *tcheat*, you are not going to learn!

Baragatti – Yes, yes, of course, I am going to teach.

Professor Baragatti got his visa and went to Brazil. After he had spent almost a year there - a very significant year, we must say – it was time to go back to the United States. Brazil, at that time being a dictatorship, controlled who could also get out of the country, so most people needed an

exit visa to leave. Professor Baragatti was unsure whether he needed an exit visa, so he went to the DOPS *(Departamento de Ordem Politica e Social),* which in São Paulo was called DEOPS *(Delegacia de Ordem Politica e Social).* The DOPS was one of the tools that the military government used to keep its authority over the population. In the words of the writer Paulo Coelho, *"the Department of Political and Social Order was a place as Orwellian and as sinister as the name suggests."* It was not a secret that torture took place within its premises. One of the characters at the DOPS was *delegado* Sérgio Paranhos Fleury, who was later accused of leading a death squad, and was later found dead amidst unclear circumstances.

Anyway, Professor Baragatti went to the DOPS and the following conversation took place:

Baragatti – Do I need an exit visa?

DOPS officer – Let me see your passport.

Baragatti – Here it is.

DOPS officer – Let me check with my superior.

Baragatti – Fine, I will wait.

DOPS officer (coming back with a second individual) – You have a *visto oficial*, an official visa. You do not need an exit visa.

Baragatti – Good, thank you.

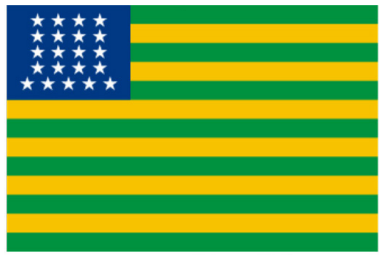
DOPS officer – Wait a second, how did you get this visa?

DOPS superior (visibly suspicious) – Yes, how did you get this visa? How did you get it, sir?

Baragatti – How the heck would I know. They gave it to me at the Consulate.

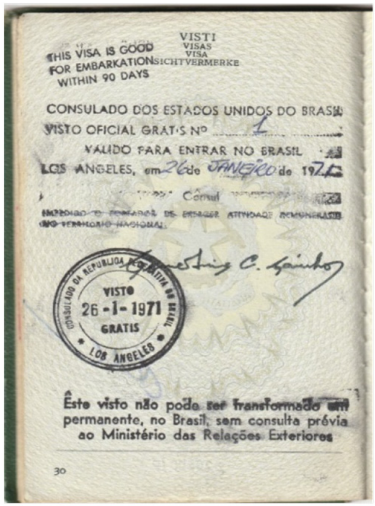
Gianluca Baragatti could not explain that he had come to Brazil to *tcheat*, since he was now speaking Portuguese, a language he had learned mainly through a female relationship. But mentioning atomic energy, the OAS, and the IAEA had a convincing effect. Physics seemed to impress people and this saved the day. Later, Gianluca realized why the bureaucrats had been suspicious. When Brazil became a republic in 1889 its official name was Estados Unidos do Brasil. That name was clearly a copycat of the United States, especially if you look at the first flag of the temporary Government of Brazil after the emperor was sent packing. Fortunately, that flag, which

had 21 stars, lasted only four days and was replaced by a prettier one that now has 27 stars. The military government changed the official name of the country to Republica Federativa do Brasil in 1967. Now, the *visto oficial* on Professor Baragatti's Italian passport contained both the new and the old name. In addition, the passport contained a transit visa from the DDR, *Deutsche Demokratische Republik*, or German Democratic Republic, East Germany of all places. Maybe the DOPS men had taken him for a dangerous communist.



Temporary flag of the
Estados Unidos do Brasil

Modern flag of the Republica
Federativa do Brasil



Visto Oficial issued by the Brazilian Consulate

Transit Visa from East Germany

Professor Baragatti could now leave the country without an exit visa.

When Professor Baragatti arrived in Los Angeles, a few days short of a year spent in Brazil, he had a United States resident visa. With that type of visa, you were not supposed to stay out of the country for more than one year. He was met by a very unsympathetic immigration officer, who likely was envious or resentful because of the attractive young woman that was accompanying Gianluca. “You are only coming back so you will not lose your visa,” said the officer. Then, pointing his finger at Berenice, who had a tourist visa valid for six months at most, he barked: “and she cannot stay.”

Professor Baragatti ignored the outburst. During the six months that he stayed in California he obtained a United States citizenship, which was possible because he had previously lived in the country for over five years. Then he and Berenice went back to Brazil for another six months. Now he had an American passport, no *visto oficial*, so this time he had to go back to the DEOPS and get a *visto de saida*, or exit visa, in order to leave the country. As an aside, the DEOPS was terminated in São Paulo in 1983, following democratization.

Vistas
SECRETARIA DA SEGURANÇA PÚBLICA
D.E.O.P.S.
Delegacia Especializada de Estrangeiros
SÃO PAULO
Visto de Saída n.º 32.714
Válido até 1º de março 1973
Portador(a) de Carteira Temporário, expedida em São Paulo para os efeitos do art. 66 do Dec.-Lei 941, de 13.10.69.
Pagou os emolumentos de Lei.
São Paulo, 1 de novembro de 19 72
Delegado de Polícia - Adjunto
Cel. José Espiato Vieira Monteiro
POLÍCIA FEDERAL DE PASSAPORTES
ESTADO DE SÃO PAULO
BRASIL
EMBARQUE
21 DEZ 1972
GUARULHOS
9

Exit Visa from DEOPS

This time reentering the United States was very different. Gianluca had an American passport and Berenice, now Mrs. Baragatti, had an immigrant visa. They were almost given the red carpet at the Los Angeles airport. The young customs and immigration officer was very friendly. Checking the luggage, he even noticed a report that Gianluca had written during his stay in Brazil and asked him if he was the author of it. Once again, physics impressed people and this saved the day.

*****

Professor Baragatti continued to watch TV. Now a panel of pundits was discussing the past, the present, and the future of the Afghanistan situation. The conversation became very boring and Gianluca gradually fell asleep. The last things he remembered were the panelists going over and over the plight of Afghan women. As soon as he was sleeping two little devils appeared on the sides of his head.

“You should apply for a consulting position with the State Department,” said the little devil on the left. “After all, you can claim experience in bringing a woman out from a country run by a dictatorship.”

“Do not listen to that idiot,” said the little devil on the right. “I can think of three reasons why you do not qualify. First, Brazil was not a hostile country. Second, the dress code of the women in Afghanistan is miles apart from what women wear (or do not wear) in Brazil. And third, the idea that you rescued Berenice is simply laughable. When you had your security

clearance renewed, the authorities interviewed your family in Italy, and they unanimously stated that Berenice was the one who saved you."

The Men's Restroom

Professor Gianluca Baragatti was traveling in Brazil. He had landed in Rio de Janeiro and he was supposed to continue on to São Paulo where he would meet his wife Berenice who had traveled there earlier in order to spend some days with her family. The reason why Gianluca had gone to Rio was that he wanted to stop in São José dos Campos, a town between Rio and São Paulo. This is where the Brazilian Embraer company, which builds airplanes for the commuter airline market, is located. Gianluca knew somebody who worked there and wanted to visit him, so he was planning to take a bus from Rio to São José dos Campos.

He arrived at the Rodoviaria station by taxi, bought a ticket and was told that the bus would leave soon. Then he heard the loudspeaker announcing that the bus for "..campos.." would be leaving soon from a certain bay, so he hurried there. He arrived just in time to have his luggage put in the storage compartment, and they barely looked at his ticket while he found his way on the bus. He sat next to a fellow passenger who turned out to be a German Benedictine monk, who was going to visit monasteries associated with his order. Gianluca and Brother or Father Konrad struck up a conversation, and, after a while, Gianluca began to suspect that he was on the wrong bus. The suspicion was confirmed by other passengers. The bus indeed was not going to São José dos Campos, but to Campos do Jordão. The two towns are very different, São José dos Campos being an industrial site where they build airplanes, and Campos do Jordão being a place for leisure, with spas, restaurants, hotels, and so on.

Gianluca was philosophical about it. “I will have to change my schedule,” he thought, “I will tell Berenice.” Among the other passengers who had assured Gianluca that he was on the wrong bus was a young French painter (of paintings, like the ones hanging in museums, not walls) by the name of Édouard Mamet (not Manet). His aspiration was to make a tropical version of the *Dejeuner sur l’herbe* and he was traveling in Brazil to find both the right subjects and the right spot for his composition. He had been in touch with a model agency in Campos do Jordão and thought he had found what he needed there. In any case, Gianluca, Brother Konrad, and Édouard, being the only foreigners on the bus, found it easy to bond together and had a pleasant conversation.

When they arrived at the destination, it was close to lunch time, so they all went together into a local restaurant. At different times they all visited the restroom. Gianluca had gone first, and, after coming out, he did not want to say anything in order not to embarrass Brother Konrad, who also went there and came back without making any comment. The last one to go to the restroom was Édouard, the French painter, who came out laughing and blurted out: “Brother Konrad, have you seen the art work in the bathroom? Not very sophisticated from a strictly artistic point of view, but it is extremely funny!”

“I have seen it, I have seen it, and it does not bother me. But what do you think of it?”

“Well,” said the painter, “It reminds me of my country. The three ladies represent *egalité*, *liberté*, *fraternité*. In this case, it is sexual liberty, equality between the sexes, and frankly, I would not mind fraternizing with those ladies.”

“But you must have noticed,” said Gianluca, “that the colors of their dresses are not those of the French flag, but rather of the Italian, or maybe Mexican flag.”

“I noticed that, but I know that the Italian flag originated shortly after the French Revolution, when Jacobin republics were sprouting up in Italy (Repubblica Cisalpina, Repubblica Cispadana) and the flag was a copycat of the French one. Besides, a few years later, Napoleon proclaimed himself King of Italy.”

“I am glad that you mentioned the colors,” said Brother Konrad, “because I can now tell you what my reaction and interpretation has been. First of all, I will say *Omnia Munda Mundis*. I know that you guys know what it means

but, for the benefit of others who may be reading this story, I will explain. It is Latin for ‘everything is clean to the one who is clean.’ We monks use it a lot and we can get away with a lot of things. For example, in the two movie versions of Romeo and Juliet (by Castellani and Zeffirelli), Friar Laurence uses that expression when he gives hospitality to Juliet in the convent. It is a very effective sentence in countering potential insinuations against improper behavior. It is a bit like when you say ‘with all due respect’ and then you can say almost anything, like ‘with all due respect, Sir, you stink.’”

Edouard and Gianluca laughed. They liked Brother Konrad. For a Benedictine monk he was not stuffy, he had a good sense of humor.

“Back to the colors,” continued the monk, “I will have you know that for me the three ladies represent the three theological virtues, namely Charity, Hope, and Faith. That is the way the virtues are represented by Dante in the XXIX Canto of the Purgatory, three nymphs red, green, and white. And if you do not believe me here are the original verses and their English translation.”

Tre donne in giro da la destra rota
venian danzando; l'una tanto rossa
ch'a pena fora dentro al foco nota;

Three maidens at the right wheel in a circle
Came onward dancing; one so very red
That in the fire she hardly had been noted.

l'altr' era come se le carni e l'ossa
fossero state di smeraldo fatte;
la terza parea neve testé mossa;

The second was as if her flesh and bones
Had all been fashioned out of emerald;
The third appeared as snow but newly fallen.

e or parëan da la bianca tratte,
or da la rossa; e dal canto di questa
l'altre toglien l'andare e tarde e ratte.

And now they seemed conducted by the white,
Now by the red, and from the song of her
The others took their step, or slow or swift.

“I noticed that the lady in green is looking into the future with binoculars, therefore Hope. The one in red holds a measuring stick, indicating that she may be volunteering on projects like Habitat for Humanity with President Carter and the like, therefore Charity. And the one in white seems to be contemplating a miraculous image, therefore Faith.”

“With all due respect, that miraculous image seems to be a reflection, something that we painters are very familiar with,’ said Édouard. “But what about you, Professor Baragatti, what was your take?”

“Just to be safe, I shall also say *Omnia Munda Mundis*. For me the one in green represents the beginning of experimental science, I am thinking Galileo and his telescope. The one in red represents classical physics, she can measure anything with no fundamental limits on precision. The one in white being the most advanced, and I am not saying this because of her décolleté, to me represents quantum mechanics. Also, the miraculous image or reflection at her side has a strong resemblance to some visualizations derived from wave functions, and also reminds me of a hologram.”

Having said that, Gianluca took out his camera and went back to the restroom to take a picture that he could show Berenice.

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When Gianluca arrived in São Paulo he showed the picture to Berenice and he told her the full story.

“I do not buy a bit of your story,” said Berenice. “I remember that restaurant in Campos do Jordão, we went there together several years ago, and you also took a picture inside the men’s restroom. While you were there the waiter told me that initially they had a somewhat similar art work

in the ladies' room, I mean a similar theme. But then someone got offended, and they painted it over. And I can also tell that you used Photoshop to change the color of the dresses to match the story of the priest, or Dante, whatever. In the original photo the green was red, the white was black, and the red was blue. And, guess what, that restaurant has been remodeled since you took that picture, years ago. But it appears that they kept the original theme in the men's bathroom, and someone posted it on the internet. You can find everything on the internet these days." "Wow," said Gianluca.

"And now," continued Berenice, "You can tell me what you really did after leaving Rio."

The BS Model

Professor Gianluca Baragatti was walking with his wife Berenice along the seaside of Avenida Vieira Souto, which runs along Ipanema Beach in Rio de Janeiro. It was close to sunset; the temperature was pleasant and the air was full with the smell of tropical flowers. Gianluca and Berenice were walking in the direction of Barra da Tijuca, where the city was developing new districts.

As usual, Prof. Baragatti was deeply immersed in his thoughts, and Berenice had to keep an eye on what was going on around them, to save him from becoming target of some petty thief or being run over by a bicycle. He was not so absent minded, however, that he would miss some interesting bikini coming out of the beach.

"Plotino, Plotino, what was that? Was that another particle within the BSM, or Beyond the Standard Model?" He could not remember. Something going back to the Lyceum studies reminded him of some classical connection, but

he could not remember.

Back at the hotel, after the walk, he took out the computer and googled Plotino (he actually got Plotinus). As he had come to suspect it was not another weird particle, but a philosopher of the Roman era who founded neoplatonism.

*****

Gianluca Baragatti had come to Rio to attend a conference on the BS (Beyond the Standard) Model, not because he was an expert in the field, but because of the attraction of the city, where he had worked in the past and of which he had pleasant memories. You have to know that Professor Baragatti was now close to retirement and that he was still employed as a senior scientist by a high technology company, a firm that was making its profits on contracts, mostly with the Government, but also with other commercial organizations. Years before Gianluca had worked at Brazilian research institutes, and he had maintained some contacts. Well, he had convinced his management to finance his participation in the conference, with the excuse of potential marketing on the side, through his contacts. Naturally he had bought an additional ticket and had taken Berenice along.

At the conference, there were a lot of young brilliant scientists, each one of them promoting his own BS (Beyond Standard) theory. Supersymmetry, Technicolor, Grand Unification. Some of them were quoting string theory, and when that happened Gianluca Baragatti could not help but being mentally redirected to the string bikinis on Ipanema Beach.

A typical excerpt from a presentation (we did not invent this) would go like this: "…by dialing the mixture of bino and wino//Higgsino, one can reproduce the dark matter relic abundance…this implies a well tempered neutralino…." Not to forget the gluino, photino, gravitino, etc.

Prof. Baragatti could not follow, of course, all the arguments, but he was fascinated by the terminology and the proliferation of 'inos.' In his days the only known particles were the electron, the proton, the neutron, the photon, and of course the neutrino.

At the end of the session, after the last question, Gianluca raised his hand and made a comment: "Enrico Fermi," he said, "was the one who introduced the term neutrino. He did it so that the future physicists would not stay with ONS." The brilliant scientists stared at him. ONS? What was that? Maybe a new BS theory they had not heard about yet? No one wanted

to show off their ignorance, besides it was time to go eat some Brazilian churrasco and the group moved out of the room.

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There was another Italian man at the conference, a young physicist by the name of Paolo. He was working at CERN and, unlike Gianluca, was at the conference for the right reasons. He was a smart high energy particle physicist. That evening Gianluca and Berenice invited him for dinner at a restaurant near the hotel.

At one point, after some caipirinhas, the young man smiled and said: "*Professore, credo di essere stato il solo a capire quello che lei ha detto oggi. Lei ha detto che Enrico Fermi ha creato il nome neutrino, cosi'che i fisici futuri non restassero cogli ONI…"*

At those words Berenice broke into laughter. The young man reddened and said: "*Non pensavo che la signora capisse l'italiano…*"

Translation: Professor, I believe I was the only one who understood what you said today. You said that Enrico Fermi coined the name neutrino so that the future physicists would not stay *coglioni*(*).

I did not know that your wife understood Italian…

(*) Coglioni: literally it means balls, but as used in Italy it means assholes. The pun "cogli ONI" has been used for example by Roberto Benigni (Academy Award 1998 for best actor in Life is Beautiful) in reference to the names of politicians whose name ends in ONI, such as BerluscONI. Professors of chemistry occasionally light up their lessons when they pronounce the phrase *cogli ioni* (with the ions).

Cyclic Boundary Conditions

The field of physics (and engineering) is crowded with differential equations, which describe processes in an infinitesimal domain. To figure out what happens in wider regions you need to solve the equations, but you also need to give or impose initial conditions (in time) and boundary conditions (in space). When dealing with certain structures, periodic boundary conditions are introduced. For example, to study the elasticity of a long chain of atoms, one may impose the condition that the vibration of the first atom in the chain be the same as that of the last atom in the chain.

This is known as a cyclic boundary condition and results in solutions that have a periodicity. This approach is useful in describing the behavior of electrons in crystals and is probably also used in computer simulations of very large molecules intended to neutralize dangerous viruses. These solutions, of which you cannot tell where they begin and where they end, bear some resemblance to the thought patterns of some individuals, who may start with a mental association and, after some rambling and circumlocutions, get back to the same concept.

*****

Professor Gianluca Baragatti was reminiscing of the time when he was in Brazil, about fifty years earlier. Specifically, he was thinking back to a time when he was having lunch at a little diner in Pinheiros, a district not far from the University of São Paulo. He was together with Kengo, a young fellow of Japanese descent who was working on his PhD degree at the University. Brazil, and especially the state of São Paulo, has a very large Japanese community. People of Japanese descent born in Brazil are very different from their relatives in Tokyo or Osaka, because, having thoroughly assimilated the Brazilian culture, they are noisy and informal. Kengo fit that pattern perfectly, and had been most valuable in introducing Gianluca to life in a different country. He had been and continued to be a useful source of information on where to find, within a reasonable budget, the best food, the best music, the best entertainment, and the best company.

On this particular day, Gianluca and Kengo had ordered *bife a cavalo*, a typical Brazilian dish. At some point Kengo mentioned that a variation of the dish could be called *bife a Camões*, a name associated with the most famous Portuguese poet. Since that day, Gianluca never encountered that expression anymore and came to believe that maybe it was just a term created on the spur of the moment. Fifty years later, reminiscing about it, he decided to look into the subject and found that in fact there is such a thing within Brazilian gastronomy.

The *bife a cavalo* consists of a slab of beef, essentially a steak but not too thick, on which two fried eggs have been superimposed. According to some, the name apparently comes from the shape of the two eggs resembling a saddle on a horse. Now, if instead of two, you use only one egg, you obtain a *bife a Camões.* Its namesake is Luis Vaz de Camões (1524–1580), the greatest Portuguese poet, whose work has been compared to Shakespeare, Dante, and the like. The name makes sense because Camões had only one eye, having lost the other while serving in a military

campaign in Africa.

Luis Vaz de
Camões

You can actually find *bife a Camões* in restaurants (at least in Brazil, and for the time being). As shown in the below excerpt from a restaurant menu, the *bife a Camões* (with one egg), can actually be more expensive than the *a cavalo* version (with two eggs). How do you explain that? Well, the *bife a cavalo* is a strong plate, with lots of proteins, and is a favored diet of workers who do hard labor, real men who do not eat quiches, and also of tough women. *Bife a Camões*, on the contrary, appeals more to elegant senhoritas and snobbish self-appointed connoisseurs, the kind who will almost endlessly swirl and sniff an inconsequential amount of wine before taking a sip. This last group usually has more money, so it is altogether fitting and proper that they pay more.

Anyway, let us get back to Camões. He is famous as the author of the Lusiads, an epic poem which exalts the deeds of the Portuguese kings and navigators. He describes the voyages of Vasco da Gama and the heroic accomplishments of the people and kings from Lusitania in an aulic style, and also brings in the Greek gods to fight along or against the navigators. Thus, Vasco gets help from Venus, while being antagonized by Bacchus, with occasional interventions by Zeus and others.

Professor Baragatti, having developed a taste for epic poems and having a

decent knowledge of the Portuguese language, started to read the poem. Right at the beginning he encountered these verses:

E também as memórias gloriosas
Daqueles Reis, que foram dilatando
A Fé, o Império, e as terras viciosas
De África e de Ásia andaram devastando;

Pay attention to the following
distinct translations of the above verses:

What kings, what heroes of my native land
Thunder'd on Asia's and on Afric's strand:
Illustrious shades, who levell'd in the dust
The idol-temples and the shrines of lust:

– William Julius Mickle (1877)

And, eke, the Kings of mem'ory grand and glorious,
who hied them Holy Faith and Reign to spread,
Africk and Asia, devastation made;

– Richard Francis Burton (1880)

Kings likewise of glorious memory
Who magnified Christ and Empire,
Bringing ruin on the degenerate
Lands of Africa and Asia;

– Landeg White (2001)

And glorious memory of that line of kings
Who through the ages magnified the expanse
Of the Faith and Empire, and kept havocking
Asia and Africa's degenerate lands;

– A.Z. Foreman (recent)

The older translations respected the rhyme, while the more modern did not; accordingly, the newer ones seem closer to the original text. But the important thing is that all of them convey the fact that the heroes of Camões are responsible for devastating, havocking, levelling in the dust, and bringing ruin to the lands of Africa and Asia! Wow! What an admission, coming from one who was simultaneously celebrating the heroic deeds of these kings and the spread of civilization!

Professor Baragatti was shocked. He had long argued with his daughter Vanessa against those who were tarnishing the legacy of another great navigator, Christopher Columbus (with whom he shared his Italian origin), by accusing him of improper actions against the indigenous populations. The second Monday in October used to be known in the United States as Columbus Day, now some people wanted it to be called Noble Savage Day, or something similar.

Now, confronted with this brazen admission of wrongdoing, Gianluca found himself experiencing a sort of moral conflict. Nonetheless, he was and remains profoundly disgusted by the despicable mobs that have overturned Columbus statues.

Professor Baragatti worried about what might be done next to the image of his beloved Columbus, and he thought: "Will this *cancel culture* also eliminate the concept of Columbus' egg?" This subject was dear to his heart, and one with which he had been involved before.

*****

So, we began this story talking about eggs and to the egg we have returned. If this reminds you of cyclic boundary conditions, it is intentional. The subject of eggs is an appropriate tool for illustrating such conditions, because as of today we are still not sure which came first, the chicken or the egg. In Italian we would say: *senza capo ne coda*, or "no head no tail."

Shadows in Copacabana

The beachside pavement along Avenida Atlantica in Rio de Janeiro has a famous mosaic pattern shaped like a wave. The promenade is four kilometers long and the pattern is created by alternating sections of black basalt and white limestone, a technique developed in Portugal in the nineteenth century. Interestingly, when the pavement was originally built around 1906, the direction of the wave was at ninety degrees from the present one, which was designed by the Brazilian architect Roberto Burle Marx in 1970. A walk on the mosaic along all of Avenida Atlantica is highly recommended, especially if one has a scientifically oriented mind.

Promenade along Avenida Atlantica today

Promenade along Avenida Atlantica circa 1920

Walking at night along Avenida Atlantica can be fun too. The promenade is well lit, with 96 poles along its length, each 22 meters high and carrying a bank of lights directed towards the beach. In addition, there are numerous street lights mounted on 6-meter poles.

*****

Professor Gianluca Baragatti had managed to spend some significant time in Brazil, either working at a research institute or as a tourist. One of the things that he now regrets is that, while he was in Brazil, he never looked at the sky at night. Part of the reason is that most of the time he was either in São Paulo or Rio de Janeiro, which are huge cities with tall buildings, and a lot of artificial light. But he had also been at more faraway places, like the Pantanal and the Amazon, where the night sky must have been fabulous as long as it did not rain. Either he never thought about it, or he was busy with other nocturnal activities, so he did not look at the night sky. Unfortunately, he now regrets never having seen the Southern Cross.

Another thing about Professor Baragatti is that he does not have a good sense of direction, a fact that his wife Berenice is always keen to point out. This explains why he thought that when walking in Copacabana, if you have the Atlantic Ocean to your right, you would be roughly facing East. This is not totally correct. The Rio de Janeiro area that includes Ipanema and Copacabana is known as Zona Sul. While some areas facing the ocean are in fact pointing South, this is not true everywhere – this variance might be what generated Professor Baragatti's erroneous perception.

In the Northern hemi-sphere, if you face East, the Sun will appear to move clockwise and most of the time (but not always) your shadow will be to your left. In the Southern hemisphere, however, the Sun will appear to move counter-clockwise, and (again, looking toward East) your shadow will be most of the time to your right.

Walking in Copacabana

On the morning of September 17, 2013, Professor Baragatti and his wife Berenice were walking on Avenida Atlantica in Copacabana. The ocean was to their right, so they were roughly walking in an Eastern direction, or so Gianluca thought. Something must have triggered Professor Baragatti's interest because, while Berenice was looking at some artifacts for sale at a nearby kiosk, he snapped a picture of the flow of people along the promenade. His scientific interest in taking the photo was probably aroused by the fact that the shadows appeared to be to the left, opposite to his intuition that expected them to be to the right. He was probably also wondering if one could use a photograph to calculate the azimuth and the altitude of the Sun when the photo was taken.

Professor Baragatti must have quickly been distracted by other events, because for many years he forgot about his original intent until many years later, when he happened to see the picture again. At that time, he went back to his original purpose. Now, there may be some, including professor Baragatti's own daughter Vanessa, who might question his motivation in taking the picture. To disprove this, Professor Baragatti carried out the following scientific (!) analysis.

Through Google Maps (street view) he found the exact location where the picture had been taken, which was near the intersection of Avenida Atlantica and Rua Barão de Ipanema. Using Google Maps (classic view) he

was able to establish that the direction of the promenade was not pointing East, but rather 29 degrees from North. He then paid no attention to the shadow of the young lady (who, by the way, happened to be accidentally in the center of the picture and of whom Gianluca has no recollection). He concentrated instead on the more serious shadow of a 6-meter street light, which can be better seen in a zoomed view of the original picture.

Professor Baragatti used the satellite view from both Google Maps and Google Earth, which depict the wavy pattern with excellent details. The pattern appears to be fairly monochromatic all along the four kilometers, with an average "wavelength" of about 5.8 meters. Using different satellite maps of the same area he could accurately enough establish the position of the base of the six-meter pole. He then used his best judgement to transfer the tip of the pole shadow on the satellite map. With this, he could estimate the angle that the shadow made with the North direction (azimuth of the Sun), and also estimate the length of the shadow of the pole, which resulted to be 6.85 meters. He obtained the following results:

Azimuth of the Sun: 63 degrees.

Altitude of the Sun: arctan (6/6.85) = 41.2 degrees.

There will obviously be errors due to using the nominal height of the pole and the localization of its base.

Now back to the young woman in the picture. Professor Baragatti again used his best judgement to transfer the end points of her shadow to the satellite map, obtaining:

Length of the woman shadow: 1.70 meters

Height of the woman: 1.70 tan (41.2^{o}) = 1.49 meters

Therefore, according to the calculation, the height of the young woman, for people in the United States who have not yet converted to the decimal system, would be about five feet.

We can take another approach and use astronomical information to find out the orientation of the Sun at that location at that point in time. The exact coordinates of the location were latitude = 22.97558 S, longitude = 43.18736 W. The information stamped on the picture shows that it was taken at 9:37 a.m. São Paulo time on September 17, 2013. Professor Baragatti used those data with the Stellarium website obtaining the following results:

Azimuth of the Sun: 57º 57'.

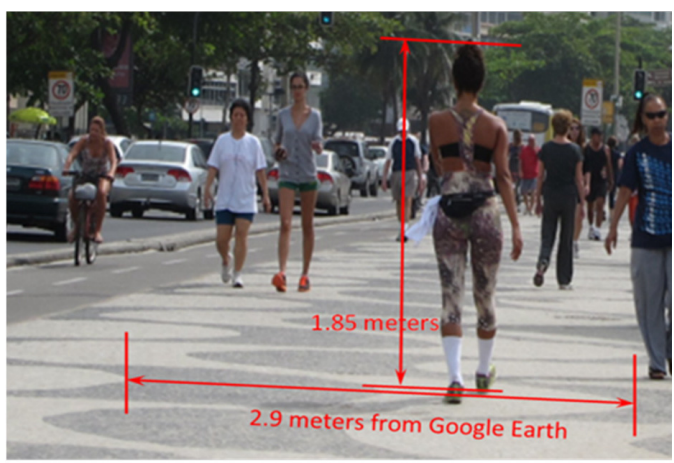
Altitude of the Sun: 48º 03'.

With this higher value of the height of the Sun Professor Baragatti obtained:

Estimated length of the woman's shadow: 1.70 meters.

Height of the woman = 1.70 tan (48º 03') = 1.89 meters.

This value, or roughly six feet, was more in line with the personal recollection of Professor Baragatti. And after going through all this madness, Professor Baragatti found a simpler way to estimate the height of the woman. First, he measured the width of the adjacent white and black bands in the Copacabana pattern, again using the satellite images. This turned out to be 2.9 meters. With the reasonable assumption that the image is not distorted, he could then calibrate the horizontal and vertical directions in the image and read the height directly. The reading appeared to give about 1.85 meters, confirming the previous result and once again in accord with the memory of Professor Baragatti...



Direct height estimate

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Since stories should have a moral, there are two lessons that can be learned from this story. First, the perception of the direction that one is taking, either geographical or metaphorical, may not always be correct. Second, one should be doubly careful when trying to assess the motivations of

people when they perform certain actions. And that caution should apply when assessing their writings too...

QUARTA GIORNATA (FOURTH DAY)
STORIES CONNECTED
WITH CLASSICAL PHYSICS

The stories narrated during this day have something to do with classical physics. Some of these stories involve calculations and some are even supported by "experiments," so to speak. While the calculations involved are all weird, an effort has been made to convince oneself that they are not totally wrong, thus attaining a conviction without which no moral purpose could even be claimed. Needless to say, just like the other stories, they contribute to the unity of the book by having a connection, direct or indirect, to some aspects of the world of physics.

The mechanical equivalent of heat and the defrosting of a steak. Famous scientists from the past challenge each other to solve hydrostatics problems. Attempts to slow down the rotation of the Earth. Applications of electricity to stimulate pleasure in the eighteenth century. These and other stories are narrated during this day.

The Electric Kiss

"We are so lucky that we live in an era of high scientific development," said the Princess Gilberte de Cambremer. It was a nice spring day in the 1700s, a century which is now referred to as the "Age of Enlightenment." She was having tea in her castle at Montremy, in Normandy, with her friend, the Duchess Oriane de Greffulhe, who was visiting her from Belgium. "I agree entirely," said Oriane, "and I love to attend the lectures and see the demonstrations that have become so popular at our social events. I really appreciate the advances made by the astronomers, who can now calculate the position of the planets with great accuracy. This has tremendously improved the quality of the predictions that I get every day from my astrologer, Madame Esmeralda. You won't believe how easy it is now for me to anticipate the escapades of my husband as well as to adjust my own love life."

"I believe you," replied the Princess, "and in fact I myself am also benefiting from the advances in astronomy. But the real progress today is in the field of electricity. Since that guy in America, Benjamin Something, I

do not remember his name, started playing with kites, our scientists here and in Germany have learned a lot about this new fluid, how to produce it and how to put it in bottles. The Count of Granville has promised to bring me a Leyden jar from his next trip to Holland. But, tell me, have you tried an electric kiss?"

"Actually, I haven't, but I have heard about it, and I am eager to try."

Electric kiss in the Age of Enlightenment

"I can help you with that. I am fortunate enough to have secured the services of one of our best traveling electricians, Maurice Sparquerin, who is in great demand from all the courts in Europe for his lectures and demonstrations on electricity. He has developed a machine with a rotating disc that creates some electricity which goes into a bottle. And I can tell you that when you get kissed by a man you feel the most exhilarating and shocking sensation. Maurice can also create electricity by rubbing a ball of jade with a cat skin."

"My dear Gilberte," said the Duchess with a smile, "for that matter I can tell you that, even though I am not a scientist, I also have observed that rubbing fur seems to have an effect on balls."

"I would say, especially since you are not a scientist…"

The two women laughed. Then the Princess resumed her mentoring: "I will introduce you to Maurice. Besides being very knowledgeable (he studied with Volta), he is also a very funny and entertaining man. He gave a mild shock to my husband, and the Prince had a wild reaction that was very similar to that of Galvani's frogs. Which made Maurice and all our guests wonder who had kissed my husband and changed his status from frog to Prince. It was a lot of fun. And Maurice knows a lot of stories, from his

experience around the continent. He actually helped set up an unforgettable demonstration for the Czar Peter III of Russia in Saint Petersburg. The Czar had invited a large number of Russian and foreign dignitaries and was determined to impress them. After a lavish banquet and lots of vodka, he had an entire regiment of Cossacks, in full uniform, stand hand in hand in the castle courtyard, with a long wire extending to the hand of the first man. At the appropriate moment the exclusive and noble audience watched in disbelief and with great enjoyment as the entire regiment flew up into the air. Isn't it great that we live in the Age of Enlightenment and that science can provide such new ways to fight the boredom of our lives?"

"Yes, and I bet that the experience was unforgettable for the Cossacks too. We need more of this progress and I will use my influence at Court to support the scientists. Long live le Roi and long live Science!"

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This story is not as absurd as it may seem. The demonstration of giving an electric shock to a group of soldiers in uniform was apparently actually done, although I have not been able to find again the reference to that event. But it has not been the first time that important discoveries in physical science have been used for the purpose of entertainment, regardless of the consequences. A case in point: not long after Röntgen discovered x-rays, people at fairs and traveling carnivals could enjoy watching the bones in their hands on a scintillating screen, while getting an undetermined amount of radiation dose.

Paradox in Paradise

It was another day in Paradise. This Paradise was populated by just two species. The first species consisted of extinct people who had actually existed and, for whatever reason, were now remembered. The second species consisted of fictional characters in books, plays, operas and so on, as long as they were still remembered. Accordingly, in this paradise of memory (or immortality, if you like), you could find Caesar, Napoleon, Jesus Christ, and also Don Quixote, Hamlet, Tosca.

Galileo was there, and so were Salviati, Sagredo, and Simplicio, the three characters that he created in his *Dialogo dei Massimi Sistemi*. In spite of a number of adjustments forced upon them by modernization and

globalization, all the inhabitants of Paradise had kept their personalities and behaved just in the way in which they were, shall we say, remembered.

Thus, it was not strange that on this particular day Salviati, Sagredo, and Simplicio were found in a corner of Paradise discussing scientific issues.

"Simplicio has brought up a problem related to the rotation of the Earth, and he also claims the existence of a paradox. Let us hear him," said Sagredo.

"Well," began Simplicio, "Talking to some of the inhabitants of this place, I have become aware of two past attempts at slowing down the rotation of the earth. Both attempts were motivated by the desire to have longer nights, in order to have more time to indulge in sexual pleasures. In any case the first attempt was apparently made in China, and it involved large masses of people continuously jumping eastward. The idea is that each jump (properly performed by falling down straight) would transfer some angular momentum to the earth and would eventually slow down the rate of rotation."

"Sounds reasonable," said Sagredo.

Salviati made an unconvinced sound.

"I have made some calculations," continued Simplicio, "and, with some assumptions, I found that it would take about two million years of jumping by a billion people to increase the length of a 24- hour day by about five minutes."

"Hard to justify, from a sexual cost-benefit standpoint," said Sagredo.

"A second attempt was made in Persia, after *One Thousand and One Nights* became a bestseller," continued Simplicio. "The idea was to increase the moment of inertia of the earth by building a huge tower, which eventually collapsed due to poor materials and corrupt subcontractors. I have calculated that to add five minutes to the day you would have to move soil from the poles towards the equator (making the earth less spherical and more elliptical), up to a maximum height of about 10 kilometers."

"This second approach would definitely work," said Salviati. "Increasing the moment of inertia would reduce the angular velocity, since the angular momentum must stay constant. To move all that dirt would take a long time, not to mention getting the environmental impact statement approved. However, I do not believe that the jumping approach will lead anywhere.

Unless we apply **external** forces, the system consisting of a jumping humanity and the earth should maintain its angular momentum, and, unfortunately, the forces applied by the jumpers are **internal** to the system."

"We need to think more about that," said Sagredo. "But along the same lines, I have often been questioned by people, including Simplicio, about an apparent paradox also related to the rotation of the earth, which I was unable to explain. Perhaps Simplicio can expose the problem."

"My pleasure," began Simplicio. "It is a fact that many nations, from Iran to Pakistan, have now developed powerful rockets. If we attach a number of these new rockets to the earth along the equator, with the discharge in the western direction, and turn them on, the earth will rotate a bit faster. So, we have spent chemical energy, but we have given more kinetic energy to the earth. This makes sense. Now, if we were to turn the rockets around 180 degrees, with the discharge facing East, maybe in the direction of Mecca, we would slow down the earth. In this second case we have wasted chemical energy, and we now have less kinetic energy in the earth, so we lose twice. Does this not seem paradoxical?"

Salviati: "It is only paradoxical because we forget that the atoms and molecules that exit the rockets are part of the system too. It is easier if we think of a big gun, attached to the earth, and a projectile ejected from the gun. Before shooting, the projectile has a certain kinetic energy. When we shoot in a western direction (opposite to the direction of the earth) its kinetic energy goes down a bit, and when we shoot in an eastern direction, its kinetic energy increases. So, when we shoot in an eastern direction, we waste chemical energy and the kinetic energy of the earth decreases, but the kinetic energy of the projectile increases thus making up for the two other losses. So, there is no paradox."

Both Sagredo and Simplicio found this argument acceptable and the three of them went to have some Chianti and pizza.

Dialogue between the Earth and the Clock

"Hello," said the clock to the Earth. He was glad to have finally engaged her in a conversation. If you wonder why the clock is masculine and the Earth is feminine, it is because it is so in Italian (l'orologio, la Terra), Spanish (el reloj, la Tierra), Portuguese (o relògio, a Terra). Even in

English, the term “Mother Earth” is popular with environmentalists, vegetarians, and people like that. “For a moment,” continued the clock, “I thought you had stopped turning, since you rotate so slowly that I could not feel your motion in real time. Not to brag, but my longest hand goes twenty-four times faster than you.” The following conversation ensued.

Earth – You may think that I rotate slowly, but at the equator every piece of me travels faster than the speed of sound. As much as you guys may want to brag, you still depend on me for the definition of time.

Clock – Sorry to disappoint you, but that is not true anymore. A second used to be a fraction of the average tropical day, or something like that. It is now defined as the time that elapses during 9,192,631,770 cycles of the radiation produced by the transition between two levels of the Cesium 133 atom.

Earth – That is just another example of the modern lack of respect for old age. I have been here for billions of years (exactly 4.543 billion, according to Wikipedia), and you have been around for a few hundred years at most. Any logical person would think that I am the wise one. But nooooo! You are the one that they say goes *clockwise,* while I and the other planets are supposed to revolve *counterclockwise* and also to rotate that way (except for Venus and Uranus).

Clock – Sorry about that. I was not responsible for that language. But how did it happen that Venus and Uranus rotate in the opposite direction of the other planets?

Earth – Well, the scientists have a couple of theories, involving my slowing down and the impact of meteorites, but I will tell you the true story. It was all because of a misunderstanding that happened long ago, when the Gods were running the show. Uranus had gotten hold of some French perfume and had drenched himself with it. Then Venus said “I like the smell of Uranus”[(1)] in front of Jupiter, who wrongly thought that the comment was addressed to him. Jupiter felt rubbed the wrong way, and, shocked and offended, decreed that those two perverts were out of sync with the rest of the Olympus population. And in those days, decisions were final, you could not appeal all the way to the Supreme Court, as they do today, until nobody remembers your case anymore.

Clock – Interesting story. What surprises me, since you were part of that period when the Gods were running loose, is that you do not have a lot of descendants. When it comes to offspring, you only have the Moon, a

snobbish and aloof character who insists upon always turning her face away from us, and only shows her backside. You have to admit that we have multiplied much better than you. There are now billions of us, we have multiplied much faster than China. My grandfather (2) used his pendulum so well that he created a dynasty. One of my cousins married well and she has become part of the Rolex family.

Earth – Well, my friend, just enjoy your short hectic life while you can. If you are lucky, you will end up in a museum, and be around a little bit longer. Otherwise, you will be crushed in a dump, most likely in disgusting company. Something tells me that I will be around much longer than you, living a long, dignified life. Because I have gravity. And I also have a lot of angular momentum. Again, according to Wikipedia, my moment of inertia is about 8×10^{44} kg m^2, which gives me an angular momentum of 6×10^{33} kg m^2 sec^{-1}, which I prefer to quote as **6×10^{40} erg sec**.

Clock – It is a big number, but why on earth (pun intended) would you use those strange units?

Earth – I shall tell you why. You know that the main components of matter - I mean protons, neutrons, and electrons - all have angular momentum. This is related to the Planck's constant, and that is usually expressed in such units. In a normally functioning society, all those tiny momenta are oriented in different ways, and mostly neutralize each other. Well, recently I have had this recurrent dream, more like a nightmare, where all those minuscule subatomic things start following the directives of a crazy leader, become potential insurgents, and all orient themselves in the same direction, thus creating a gigantic angular momentum. Would that be larger than my own? Could a conspiracy like that have the potential of even stopping my rotation? I confess that I have been too scared to even do the calculation.

Clock – Well. I can help you with that. If we assume that the electrons are about half of the nucleons in the atoms, which is certainly true for those that form over 90% of your composition, the number of potential insurgents, as you call them, is roughly

$$\frac{3}{2}\mathbf{M}\frac{1}{m}$$

where M is your mass, and m is the mass of the proton. Since your mass is about 6×10^{27} g, the mass of the proton is about 1.7×10^{-24}, and each subatomic little devil would contribute an angular momentum of

$$\frac{1}{2}\frac{h}{2\pi}$$

where h is the Planck's constant, or 6.62×10^{-27} erg sec, the total angular momentum of the potential insurgents would be about $\mathbf{2.8\times10^{24}}$ erg sec. You do not have anything to worry about. You win by 16 orders of magnitude.

Earth – Well, I am glad to hear that. I consider it a victory for classical mechanics over that crazy quantum business. And since you helped me in figuring this out, I will forgive you for your previous conceited attitude. What would you like to talk about next?

Clock – Beep...beep...beep...

Earth – Holy cow, his battery must have run out! Luckily, I do not have that problem...

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Notes – These notes are intended for speakers of a foreign language, who may or may not have a complete familiarity with some nuances of the English language.

(1) Straight from the internet, how to pronounce Uranus: if you don't want people to laugh, you should pronounce it the way that astronomers and physicists pronounce it: "Yurr-en-us." If you want to generate a few snickers from your audience, feel free to use the more vulgar pronunciation: "Yurr-ay-nus," which sounds like "Your anus."

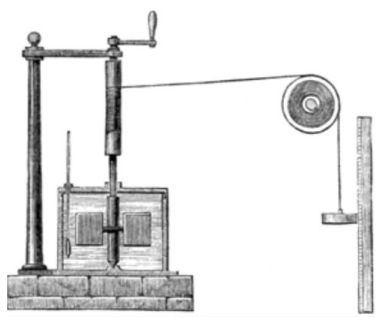
(2) What is known in Italian as orologio a pendolo translates into English as grandfather clock.

Steak a la Joule

Professor Gianluca Baragatti had found out that someone had created a recipe with a name that was connected with a personality from the world of physics, more specifically quantum physics. The recipe, *Potatoes a la Brillouin*, was named in honor of the French physicist Leon Brillouin, and his Brillouin zone, a unit cell used in solid state physics. The potatoes in the recipe are cut in the shape of a particular Brillouin zone, thus the name. Gianluca did not try out the recipe, because it was too complicated. "You

have to be a nut to do something like that," he thought. But he was intrigued by the idea of creating a recipe that would be connected to physics, would be named after a famous scientist, and would maybe teach something to the poor souls who would be crazy enough to try it out.

Since he had been reading about the history of thermodynamics he knew that, before the nineteenth century, heat had been thought to be a fluid, the so called *caloric*. By the middle of the nineteenth century people had realized that heat was actually a form of energy. In 1845 James Joule, using a contraption like the one pictured here, determined the mechanical equivalent of heat. Essentially you do some mechanical work (which you can measure), agitating the water in the container. You can measure the increase in temperature and thus compute the amount of heat you have added by agitating the water, The ratio is the mechanical equivalent of heat, which turns out to be about 4.2 joules (unit of work) per calorie (unit of heat).



"How about if one could somehow determine the mechanical equivalent of heat in a kitchen," thought Gianluca, "I wonder if one could get even closer to the known value." And, since Berenice was temporarily out of town visiting one of their daughters, he proceeded with some testing and created the following recipe.

STEAK A LA JOULE

Ingredients and needed equipment

One frozen loin steak

Board

Meat pounding mallet

Digital scale

Digital meat thermometer

Clock

The purpose of this recipe is to defrost a piece of meat, and, in the process, learn or relearn some basic physics concepts. While the preparation parameters can be changed, we will use as an example the procedure and data used by Professor Baragatti in the creation of the original recipe. Because it is easier to use devices that read out in metric units, we will use grams in lieu of ounces and the Centigrade scale in lieu of Fahrenheit.

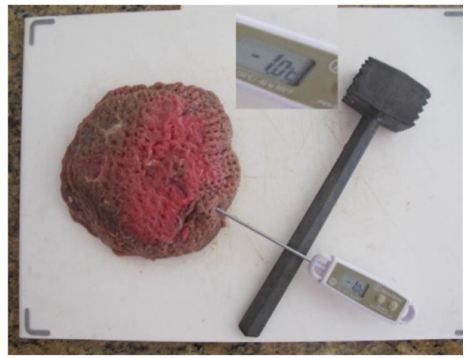
Begin by weighing the chunk of frozen meat. Baragatti trimmed the meat so that the weight was exactly 250 grams. Then make an opening in the meat and insert the thermometer. As can be seen in the picture the temperature was minus 4°C. Next, start beating the meat with the mallet, maintaining as much as possible a uniform pace. To obtain an estimate of frequency, count the number of times you swing the mallet in one minute.

Professor Baragatti counted 117 hits in one minute, and for the sake of simplicity he assumed a frequency of 120 hits per minute. Write this result down, then continue beating the meat as long as you want, while maintaining the same rhythm as when you calibrated the system. Now, let us say that you have been doing this for 25 minutes. This means that you have been hitting the meat for a total of

$$25 \times 120 = 3{,}000 \text{ times.}$$

At this point measure the temperature again. Professor Baragatti found a temperature of minus 1°C. Ignoring all arguments about environmental heat transfer, homogeneity, etc., (of which he was well aware), he accepted that the temperature increase was 3°C **and** that this increase was due to the beating with the mallet. The specific heat of frozen beef loin, as found in

the Engineering Toolbox, is 0.35 cal/g°C.



Gianluca Baragatti could now easily calculate the quantity of heat Q introduced into the meat by the mechanical work (the pounding of the meat).

$$\mathbf{Q = 0.35 \frac{cal}{g°C} \times 250g \times 3°C = 262.5cal}$$

We turn now to the mechanical work. The kinetic energy of the head of the mallet can be computed as

$$\mathbf{T = \frac{1}{2} m v^2}$$

where m is the mass of the head of the mallet and v is the velocity of the mallet when it hits the meat. The mass m is easy to find, in this actual case it was 80 grams. As for the speed of the mallet we do not know any practical way to measure it (remember, we are in a kitchen). Looking on the internet, Gianluca Baragatti found several discussions on the speed of a hammer hitting a nail. There seems to be some kind of agreement that a maximum speed would be around 10 meter per second. But that is for a strong carpenter, making a big swing with a heavy hammer. Gianluca estimated that for a wimpy old scientist swinging a small mallet over a short arc the speed would be more likely about 1 meter per second. With these numbers he calculated the total mechanical work M:

$$\mathbf{M = \frac{1}{2} 80g \times (100cm/sec)^2 \times 3000 = 1.2 \times 10^9 erg}$$
$$\mathbf{= 120\ joule}$$

Therefore, the mechanical equivalent of the calorie, as determined by this experiment, pardon, recipe, would be

$$\frac{M}{Q} = \frac{120}{262.5} = .456 \frac{joule}{cal}$$

The accepted value of the mechanical equivalent is 4.18 joule/cal, so we are at least within an order of magnitude. Gianluca Baragatti was reminded of one of his old colleagues, Dr. Greeninski, who on similar occasions used to say: "Good enough for government work."

And what about the meat? Where is the rest of the recipe? Well, you can do what you want with it, we refer you to the literature. There are thousands of ways to deal with a steak, even one that has been badly beaten up.

After finishing the calculations, Gianluca thought: "I am glad that I do not have to write a story about this crazy thing. I would not want Berenice, or my daughters, and maybe even my friends to read about this."

Physics during the Christmas Holidays – Part 1

The Christmas holidays were approaching, and Professor Gianluca Baragatti was wondering, for no obvious reasons, whether physics might play a role in the festivities. He had also started, again for no obvious reasons, asides perhaps for some inherent desire to escape into the past, to read epic poems that had been written centuries before. He had gone through the *Orlando Furioso* by Ludovico Ariosto, written in Italian, and was now trying to read *Don Juan*, written in English by Lord Byron. One line in the last poem attracted his attention:

The tree of knowledge has been pluck'd—all 's known—

These words, written by Byron in the1820s, reminded him of quotes from famous scientists. He thought specifically of Lord Kelvin and Albert Michelson who, at the beginning of the twentieth century and not long before the discovery of relativity and **quantum** theory, believed that essentially everything was known about physics. According to statements attributed to those scientists, there was nothing new to be discovered in physics; all that was left to do involved making ever more precise measurements. "We should not believe any predictions," thought Gianluca, "especially those made by famous scientists and by technology or religious

gurus. I shall maintain a healthy dose of skepticism about statements coming from shepherds of all flocks."

Trying to read epic poems in Italian and English brought to mind some comparative language considerations and especially the difference in the meaning of specific words. In English, the word *helmet* refers both to the head protection worn by medieval warriors and to that worn by today motorcyclists. In Italian you say *elmo* in the first case, ad *elmetto* in the second. Thus, *elmo* is the stuff that can appear in national anthems and not surprisingly is a prominent word in Italian epic poems; you could not exchange the two words without creating ridiculous effects. Which brings us to Don Quixote, and the *elmo di Mambrino*, or Mambrino's helmet.

Mambrino was a fictional Moorish king (celebrated in French poems of the Carolingian Cycle), who had a pure gold helmet which rendered its wearer invulnerable. The helmet was then worn by the knight Rinaldo in Ariosto's poem, and was eventually made even more famous by Cervantes' novel. In a famous episode, Don Quixote sees a barber who was caught in the rain, and who, in order to protect himself from the pouring water, had put his copper basin on his head. He mistakes the man for a great knight wearing the mythic Mambrino's helmet and vows to win it from him. The barber, scared at the sudden weird appearance of this adversary, runs away. He leaves behind his mule and basin, and Don Quixote proudly wears the helmet. The "Golden Helmet of Mambrino" song is one of the highlights in the 1972 musical *Man of la Mancha*.

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As noted at the start of our tale, Christmas was approaching. As was their usual custom, the Baragatti's family tradition involved putting up a Christmas tree, complete with ornaments, lights, and so on. Therefore, Professor Baragatti started thinking about procuring a fresh tree, preferably a noble fir. He thought of putting the tree on top of the car and considered how to secure it. At that point he remembered that, somewhere in the garage, there was a cargo ratchet strap which he had not used for a very long time. So long, in fact, that he had forgotten how to use it. Therefore, once he found it, Gianluca took it outside in the backyard and sat on a little stool to check it out. While concentrating heavily and trying to figure out the functioning of the ratchet mechanism, he must have shifted his weight to the edge of the stool, which turned over and let him unceremoniously fall to the floor.

Luckily his head did not strike the concrete! But it did hit the rim of the dogs' water bowl, which turned over, delivering to him an unwanted shower. It is unfortunate that a camera had not been there to catch the event, which must have been quite hilarious; despite some cajoling from family members, Gianluca was not in the mood to repeat it, so that it could be documented and posted somewhere. He realized that to some extent he felt like Don Quixote, since fate had put a version of Mambrino's helmet upon his head. And also, he thought, some principles of physics regarding equilibrium had been involved, maybe even violated, most notably the laws of **statics**.

Still life with
'Mambrino's helmet'

As for the cargo ratchet strap, it was never used. After buying the tree, Gianluca's wife Berenice and his daughter Vanessa refused to load it on top of the car. Instead, they outsmarted the tree and convinced it to enter the car through the back door and took it home that way.

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After the tree was brought safely home and set on a stand, work began to properly decorate it with ornaments and strings of lights. Two problems emerged with the strings. The first one was entanglement, since the things were all clinging together in a huge knot. This should have reminded Professor Baragatti of the myriad of sexual and romantic entanglements that he had encountered in his classical readings. Instead, he thought of quantum entanglement, a strange and still somewhat controversial property of particles that is definitely associated with **quantum physics**. Apparently, when two particles are in an entangled state, an action on one determines

an instantaneous effect on the other, no matter what their distance. This brings to mind a crazy proposal made in 1688 to determine longitude at sea, at a time when the clocks were not accurate enough to establish time simultaneity. According to the proposal a wounded dog would be placed on a ship. A bandage or knife associated with the wound would remain at the home port and would be plunged into the "Powder of Sympathy" at midday. The powder was expected to cause pain in the dog's wound thousands of miles away causing it to howl and thus providing a "canine time signal" from which the longitude could be determined on the ship.

The second problem, once the entanglement had been resolved, was that a section of one string would not light up. After reviewing Maxwell's equations in one of his old textbooks, Gianluca was able to fix the problem and the entire string lit up beautifully. Professor Baragatti was happy to find out that another area of physics, namely **electromagnetism**, had proved to make an important contribution to his family Christmas holidays.

Physics during the Christmas Holidays - Part 2

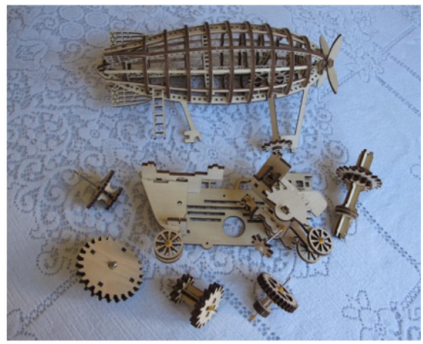
The Dirac equation is a relativistic extension of the Schrödinger equation and is an important part of **quantum** physics. While not entering in details about its meaning, in its symbolic form it can be found on a memorial stone for its discoverer on the floor of Westminster Abbey. Professor Gianluca Baragatti had visited the site and had suffered until the end of a religious service in order to see it. After coming back from London, he had used a laser cutting technique to obtain, from colored plastic sheets, letters and symbols that would fit snugly into holes similarly created and which would represent the equation.

Something reminded Professor Baragatti, who was still thinking about ways in which physics can play an active role during the holidays, of that previous endeavor. On Christmas Day he got a gift from his daughter

Belinda: a three-dimensional puzzle consisting of 229 pieces. If all the pieces were correctly put together one would obtain a strange air vehicle capable of moving on its own after winding up an internal spring. Unlike conventional jigsaw puzzles, in which the pieces are readily available, in this case the pieces had to be snapped out of sheets of hard cardboard. This is what reminded Gianluca of the time when he had used laser cutting, a technology that would not be with us were it not for **quantum solid state physics.**

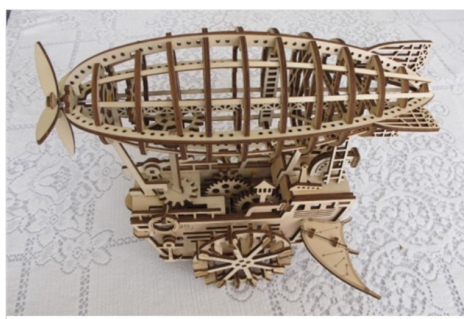
Professor Baragatti realized the difficulty of the project right away but was not discouraged. After a while, it seemed to him that the puzzle pieces started to acquire an anthropomorphic aspect, with characteristics and behavior that made them look somewhat similar to people. The more Gianluca looked at the puzzle the more he recognized commonalities with humans. To start, we are all different from each other. We get involved in projects and we are often small pieces of a puzzle that is bigger than us and that we may not even comprehend in its totality. As with humans, some of the pieces in the puzzle were essential, while others were purely decorative. As irrelevant as this may seem, the pieces were to be connected together through a mechanism that the Italians call *incastro a maschio e femmina* and in English is called *tongue and groove*.

Some pieces were easy to work with and displayed a good disposition for team work. But other pieces seemed to be actually working against the project and showed a strong proclivity for disruption of what we today would call a peaceful transition from a wrapped box to a finished product. They did this by artfully displaying some symmetry or pseudo symmetry which meant they could easily be put in the wrong place, something that was discovered only later and which sometimes required disassembly of partially complete parts of the structure. And, something that is not unusual in real life, most of the pieces that had joined together easily and sweetly were the ones that were the most recalcitrant and combative in coming apart, a painful process. In such cases, they required application of a lot of force, and applying force in a fragile environment is dangerous and can be destructive. In such situations, it is important that the force be applied in a smooth and controlled way, which Gianluca Baragatti attained, occasionally, by using a vise he had in the garage.



Components after
attempted disruption

Fortunately, in spite of the difficulties and the uncooperativeness displayed by a number of pieces who clearly showed irrational behavior and disrespect for the common rules of civility, we are happy to report that the project was ultimately a success. The gears were actually turning, although not as smoothly as in a Swiss watch. An inaugural demonstration run was scheduled, the spring was wound, and the air vehicle moved several feet on its own power on the floor of the Baragatti residence, thus restoring confidence in the rule of law. This was particularly celebrated given the tendency toward chaos and disorder that seemed to be prevailing as we neared the end of 2020.



Air vehicle ready for
the inaugural parade

Actually, another area of physics was used and abused during the holidays. Most of the family activities revolved around cooking, including but not limited to *cervello fritto* (fried veal brain), cannelloni, barbecued *picanha* and tri tip, *feijoada*, roasted pork loin, oysters Rockefeller and on the half shell, shrimp, crabs, scallops, ham and quiches. Accordingly, we can safely

say that the most useful and important field of physics employed during the Christmas holidays was **thermodynamics**. It is believed that Professor Baragatti gained some mass during the period. Regrettably, this did not result in any visible gain in energy, counter to what would be expected according to the principles of **special relativity**. Professor Baragatti believed this quandary was not of significant importance and discouraged further investigation into its causes or potential remedies.

Napoleon's Hat

The history of physics illustrates that sometimes experimental data have been perfectly described in analytic form before the appearance of a theory that could explain their rational derivation. In other words, someone started to play with numbers until they found an equation that produced a perfect fit to the experimental data. One example might be Kepler's law of elliptical orbits of the planets, which appeared before the advent of Newton's theory of gravitation. Another example is provided by the Balmer's formula, which reproduced the frequencies of a series of lines in the spectrum of hydrogen, before their exact evaluation by quantum theories, from the Bohr model to the Schrödinger equation.

*****

Gaston de Monchapeau was a mathematics instructor at the Lycée Charlemagne in Rouen, France. It was the middle of the 1920s, a time when new artistic, literary, and scientific movements were appearing and changing the cultural landscape of the world. Gaston was thirty-five years old, *nel mezzo del cammin della sua vita* as Dante would have said, or midway upon the journey of his life. He was the last descendant of an aristocratic family that, for various reasons, had lost its status and most of its wealth.

In his youth Gaston had read the novel Madame Bovary, written by his fellow citizen Gustave Flaubert. The novel describes the unraveling of a young woman's life. She is married to an inconsequential and boring doctor and, led by her romantic aspirations, she pursues some unsatisfactory affairs and accumulates huge debts; these escapades end badly. The novel had a huge impact on young Gaston. Every time he looked at a woman in Rouen, he saw within her a potential Madame Bovary. His concerns might explain why, at the age of thirty-five, he was

still single. He also felt that marriage would eventually limit his freedom, preventing him from full dedication to his two extreme and almost obsessive interests.

The first interest was in applied mathematics, which induced him to do all kinds of numerical calculations about things that he encountered in his daily life. The second one was a passion for the history of the Napoleonic era. Gaston had a great respect for the past emperor, probably due to his family history, since one of his ancestors had held a government office under Bonaparte.

Napoleon is always pictured wearing his classical bicorn hat. I do not know about you, but I have a hard time imagining Napoleon taking a shower without his hat on. One day Gaston had an idea: could he find a function that would analytically describe the shape of Napoleon's hat? It would have to be a function with a simple, elegant form, not a combination of different expressions with ad hoc coefficients, that way anyone could do it. Initially, he tried to adjust some functions which are well-known in mathematics and physics. He tried first with the Gaussian, which describes the distribution of random errors, and which has the simple elegant form:

$$f(x) = \frac{1}{\sigma\sqrt{2\pi}} e^{-(x-\mu)^2/(2\sigma^2)}$$

Next, he tried with the Lorentzian, which is used to describe the shape of resonance lines in neutron cross sections, and which also has a simple elegant form:

$$L(x) = \frac{1}{\pi} \frac{\frac{1}{2}\Gamma}{(x - x_0)^2 + (\frac{1}{2}\Gamma)^2}.$$

It was soon pretty clear that none of these functions would work. The figure shows that the Gaussian (dotted line) and the Lorentzian (dashed line) are way off from describing the shape of Napoleon's hat. But Gaston was not discouraged. Keep in mind, Gaston did not have a computer and had to do his calculations by hand, manually graphing the results! After months of hard work and countless attempts, he finally succeeded and found a formula that perfectly matched the shape of the hat (continuous line). His formula also had a beautifully simple and elegant form, which is why we regret so deeply that all knowledge of it has been permanently lost. Unfortunately, Gaston de Monchapeau did not immediately publish his

finding. After his long and hard labor, he was exhausted and in need of some relaxation, so he decided to take a vacation. He went to Le Havre, which was the closest port to Rouen, and embarked on a ship bound for South America. When he arrived in Recife, in the state of Pernambuco, he became aware of the existence of cangaceiros, a sort of bandits that were roaming the cangaço, the arid lands of Northeastern Brazil. Not surprisingly, Gaston was fascinated by the shape of the hat used by the cangaceiros and considered the possibility of finding an equation describing that shape. He began some work on this new project but it was Carnaval time, and the town was filled with rhythmic music and young women of mixed races swaying their hips to the sound. You cannot blame Gaston for being distracted by these other, more attractive, curves. He wound up starting a relationship with Iracema, a young Brazilian woman with a lovely light brown skin color, who made him forget his previous obsessions and who eventually agreed to marry him. This shared parallels with his hero Napoleon, who had married Josephine Beauharnais; Josephine had been born in the Martinique and was considered to be of mixed blood or Creole descent.

Napoleon's hat and fitting curves

Cangaceiros in Northeastern Brazil

And guess what, Iracema turned out to be just the opposite of Madame Bovary. She was pretty and elegant, and also simple, smart, and full of common sense when it came to running a household and the handling of financial matters. Gaston gave up his previous numerical activities, destroyed his records, and even forgot the details of the equation that he had found.

And that is why today, among the available mathematical distributions, regrettably we do not have a Napoleonian or a Cangaceiran. As for the cangaceiros, the last of their kind were killed, decapitated, and their heads displayed in public. A bad end to be sure, even worse than that of Madame Bovary.

From Turkey to Paradise

In preparation for his family's traditional Thanksgiving meal, Professor Gianluca Baragatti was basting a turkey. Periodically, he would open the oven, collect some hot juices from the bottom of the pan that contained the bird, and distribute them in an impartial way on the breast, legs, and wings.

After sucking up some more juices with the baster, Gianluca mused: "When I squeeze the rubber bulb, I expel some air, thus creating some vacuum. Because nature abhors a vacuum, the baster is more than happy to fill up with hot juices. At least that is what Aristotle would have thought while baking his turkey. We now know better, thanks to people like Torricelli and Pascal."

With these and other thoughts in his head, Professor Baragatti retired to the couch. He was wondering about the name of the bird being roasted. While it is called *tacchino* in Italy, in two countries it assumes the names of other countries. In America it is called *turkey*, and in Brazil is known as *peru*. In spite of these linguistic differences, it is likely that in each of these countries the bird's meat is appreciated (while dead and properly cooked), while its demeanor (while alive) is associated with that of a pompous person.

His wife Berenice had gone out to buy items needed for a proper celebration of Thanksgiving, after reminding her husband not to forget to continue properly basting the turkey every so often. "I will definitely remember that," thought Gianluca while making himself more comfortable on the couch.

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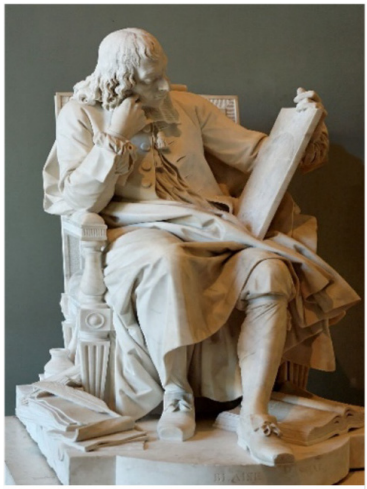
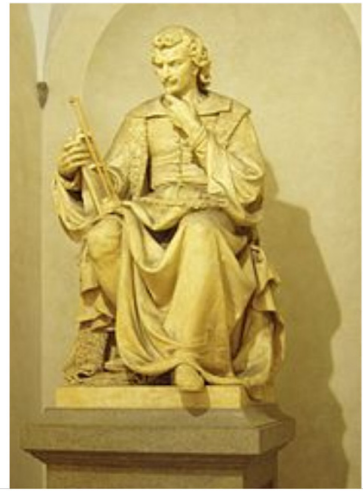


Blaise Pascal
(1623 – 1662)

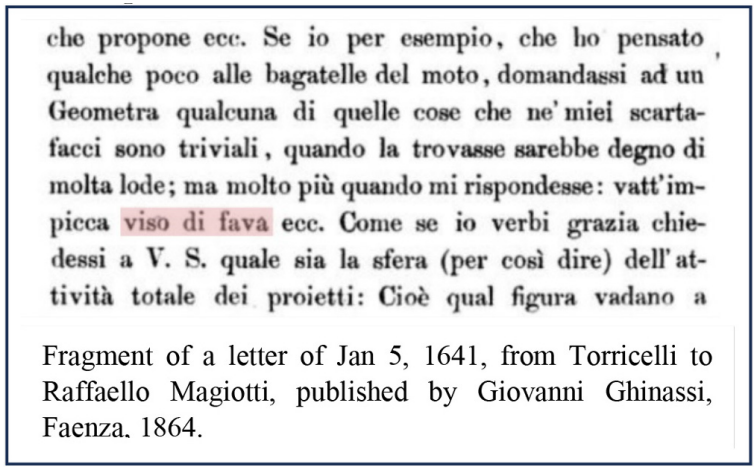


Evangelista Torricelli
(1608 – 1647)

Evangelista Torricelli and Blaise Pascal were sitting on a cloud in Paradise having a conversation.

Pascal - My dear Evangelista, it has occurred to me that we seem to have a good number of things in common. To begin with, we both died when we were only thirty-nine years old. We were both excellent mathematicians and could have made more discoveries, had we lived longer.

Torricelli – I agree, and both of us were also practically and mechanically inclined. You invented the first mechanical calculator and built several of them, while for some time I was producing the best lenses and telescopes in Europe.



che propone ecc. Se io per esempio, che ho pensato qualche poco alle bagatelle del moto, domandassi ad un Geometra qualcuna di quelle cose che ne' miei scartafacci sono triviali, quando la trovasse sarebbe degno di molta lode; ma molto più quando mi rispondesse: vatt'impicca viso di fava ecc. Come se io verbi grazia chiedessi a V. S. quale sia la sfera (per così dire) dell'attività totale dei proietti: Cioè qual figura vadano a

Fragment of a letter of Jan 5, 1641, from Torricelli to Raffaello Magiotti, published by Giovanni Ghinassi, Faenza, 1864.

Pascal – At least you made some money out of that activity. My calculators never took off and were mostly a curiosity for rich people. But we are mostly known for our contributions to hydrostatics, which we achieved by studying the pressure of fluids. At least people remembered us, not just with statues, but by associating our names with units of pressure.

Torricelli - I know, and I feel bad about it. It does not seem to be fair that one Torr is equivalent to 133.32 Pascals.

Pascal – Do not worry about it. Besides, you were the first one to realize that the weight of the air is the reason for the rise of water and mercury, not nature's distaste for a vacuum. Even Galileo did not know that. In a famous letter to Cardinal Michelangelo Ricci you wrote: "*We live submerged at the bottom of an ocean of the element air, which by unquestioned experiments is known to have weight*." That was a phenomenal insight.

Torricelli – Thank you. Speaking of letters, I have to say that mine were quite different from yours. My letters were more to the point, either discussing mathematical demonstrations, or asking for money for my lenses and telescopes. Your Provincial Letters were incredibly long, in which you argued about theology, sufficient grace, and efficacious grace. They created a sensation within the circus of Jesuits, Jansenists, Jacobins, Dominicans, and so on. But with all due respect, and even considering where I am sitting now, I think that those arguments were a lot of bull. By the way, more of my letters were published in 1864.

Pascal – I saw those and I had fun reading them. Especially the one in which you use the expression *viso di fava*, which I guess in modern Italian

would be *testa di cazzo*, roughly equivalent to asshole in English.

Torricelli – In my defense I must say that the expression, vulgar as it is, was directed at myself.

Pascal – In 1662, just the year when I died, Robert Boyle published the law that is commonly known under his name. This law stated that pressure multiplied by volume is a constant in a gas at constant temperature. It has occurred to me that either one of us could have discovered that, by making careful measurements of the change of level when a barometer is dipped into a liquid.

Torricelli - I know! Boyle realized that when you retract a cylindrical object from a cavity with which you have good intimate surface contact you create a vacuum that is hard to maintain. Nature knows that and her response sometimes results in population increases, but forget I said that! Boyle built an enormous, almost obscene vacuum machine with a huge cylinder and piston that he used for comparative studies in air versus vacuum. He even killed birds and other animals in his evacuated glass chamber. His celebrated pressure times volume law seems to have been an afterthought and not his main aim. Truth is, we did not know then what air was. Some people thought of it as a substance like cotton, the pressure felt after compression was called the *spring of the air*.

Pascal – We know so much more now. In fact, given our knowledge about pressure and volume, I want to give you a quiz. Suppose that we have one of your barometers, a cylindrical glass tube, hermetically closed at one end and open at the other. It is exactly 100 cm long. When partially filled with mercury and with the open end submerged in mercury to a depth of 5 cm, the level of the mercury is exactly in the middle of the barometer. We can mark the position of the mercury on the barometer. The question is: if I push the barometer down a further 35 cm, so that the open end is now 40 cm below the surface, what happens to the level of the column of mercury? How does it vary with respect to the mark we made? In accordance with modern testing methods, I shall give you multiple choices:

a) It stays the same
b) Goes up 8.27 cm
c) Goes down 17.17 cm
d) Goes down 3.41 cm

Torricelli – Elementary, my dear Blaise. This would have been easy to solve even when we were down on earth. Up here, in this environment, it

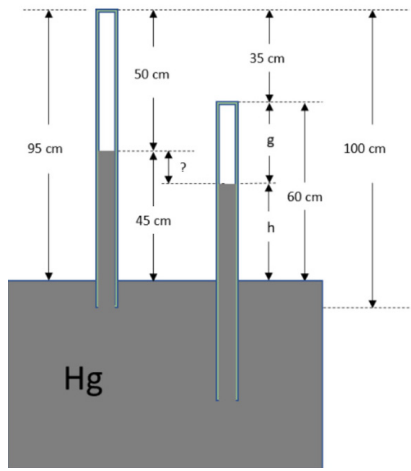
goes even faster. Obviously, the correct answer is...

*****

Berenice walked in and Professor Baragatti suddenly woke up. “Did you remember to baste the turkey?” she asked with a knowing face.

“Turkey? What turkey? Oh, sure, the turkey.” Gianluca quickly went to the oven, created some vacuum in the baster and sprayed the bird (which was becoming a little dry) with an equitable distribution of hot juices. Then he went to his desk and started to work on the solution to Pascal’s quiz. It took him some time, but eventually he got it right. Can you?

Solution for turkey quiz



We assume that temperature and pressure are standard. All the pressures are measured in centimeters of mercury. Consider the column of mercury above the level of the liquid in the container. At the bottom the mercury is subject to a pressure of 76 cm from the air (760 mm). This is balanced by the pressure of the column of mercury (45 cm), plus the pressure of the air in the top part of the barometer. This air pressure is inversely proportional to the volume in which the air is contained, which, since the cross section of the barometer is constant, is proportional to the length of the region, 50 cm. Thus:

$$76 = 45 + \frac{C}{50}$$

from which C=1550 cm^2.

When we insert the barometer 35 cm, the length outside the liquid is now 60 cm. If h is the length of the column of mercury and g the length of the air region we have

$$76 = h + \frac{C}{g}$$

But we also know that

$$h + g = 60$$

Combining the two equations

$$16 = -g + \frac{C}{g}$$

or

$$g^2 + 16g - 1550 = 0$$

This is a quadratic algebraic equation with the positive solution

$$g = \frac{-16 + \sqrt{16 \times 16 + 4 \times 1550}}{2} = 32.17$$

$$h = 60 - g = 27.83$$

The level of the barometer is now 27.83 cm, therefore it has dropped

45 - 27.83 = 17.17 cm.

The right answer is c).

From Baccalà to Paradise

Professor Gianluca Baragatti was preparing a dish that he had not eaten for over fifty years, in which the main ingredient is dried salted cod. The dish is known as *baccalà* in Italy and *bacalhau* in Portugal and Brazil. Gianluca was preparing it in the style of *Baccalà dei Frati* or in *the manner of the monks*, a kind of soul food recipe from the Veneto region in Italy. If you were to search for it on the Internet, you would find a huge number of recipes, some in English, and most in Italian. The number of variations in

these recipes is probably larger than the number of religious orders of monks in the seventeenth century, except for one component. All the recipes recommend soaking the *baccalà* in water for at least twenty-four hours.

Gianluca had completed a preliminary desalting operation and was now slowly cooking the *baccalà* in a pan on the stove with onions, garlic, and other aromatics. He would later add raisins and pine nuts, soak it all with milk, and cook the dish slowly in the oven, to be eaten with an accompaniment of polenta.

He figured that on the stove's lowest flame the cooking process would take some time, so he retired to the sofa, planning to periodically check and stir the fish mixture. Berenice had gone out on some errand and the house was quiet.

*****

Evangelista Torricelli and Blaise Pascal were again sitting on a cloud in Paradise continuing their conversation.

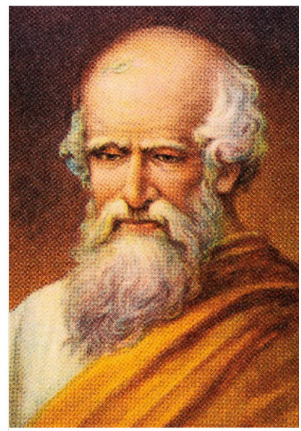
Torricelli – My dear Blaise, last time you presented me with a quiz which I was happy to solve. Now I want to try one on you, if you will.

Pascal – Shoot. Not literally. There is enough of that down on earth.

Robert Boyle
(1627 – 1691)

Torricelli – I know. So, let us go back to the barometer. This time, let us consider the glass too, which has a weight and receives a push upwards when it is forced down into the mercury. In solving your quiz last time, I

made use of Boyle's law, which states that pressure times volume is constant. This time, I suspect that we will need Archimedes' principle too. As a matter of fact, I have invited both Boyle and Archimedes to take part in this conversation and consult, if necessary.



Archimedes
(c. 287 – c. 212 BC)

(Robert Boyle and Archimedes appear and sit down on the same cloud.)

So here is the deal. In the experiment (or set of experiments) that you suggested to me last time, the glass tube did not stay in place by itself. You had to hold it with your hand and then move it up and down.

Pascal – I know, and I got many puzzled looks about that. They thought I was a pervert.

(Archimedes and Robert Boyle start an animated discussion on whose principle and law has more of an effect on the equilibrium of the glass tube. Archimedes argues that if you fill the tube completely and let the mercury fall down to 76 centimeters you have no air, so in that case Boyle is out of the picture).

Torricelli – Well, the initial condition involves air, so Boyle stays in the picture. The setup is the same as last time, but I will give you more information. The 100 cm long tube, closed at one end, has an external diameter of 1 cm, and an internal diameter of 0.8 cm. Put another way, the wall thickness is 1mm. The material used is my best glass, with a density of 2.5 grams per cubic centimeter. And, as you know, the density of mercury is 13.6 grams/cm^3.

Now, I have two questions:

1) What is the force that you would have to apply in order to keep the tube submerged for 5 cm and 40 cm, respectively? We agree that the force is positive if we have to hold the tube up to prevent it from sinking, and negative if we have to push it down to keep it into the position. If this force is zero, the tube floats.

2) What would happen if you were to stop holding the tube (you can still support it on the sides, to prevent it from falling over)?

In keeping with the modern use of multiple choice tests, here are the suggested answers:

1)

a) 2.54 N and -1.35 N

b) 3.52 N and 1.05 N

c) -1.25 N and -3.71 N

2)

a.) The tube floats with a submerged part of about 15cm.

b) The tube falls to the bottom.

c) The tube floats with a submerged part of about 53cm.

Pascal – You are tricky, mon ami. I suspect that this time we will need to use some interpolation. I may know the right answers already, but just to be sure, let me consult with our two distinguished scientists here.

(Blaise Pascal writes his solutions on a piece of paper and passes it to Archimedes and Boyle who nod affirmatively, then give it to Torricelli).

Torricelli – I knew you would get it right, Blaise. But now let us have some fun and sing along all together to celebrate. I recommend a very old folk song from my country, *La Mula de Parenzo*, or *The girl from Parenzo*. the old Italian name of a city in Istria, now part of Croatia, called Poreč. The lyrics at the end of the song are:

Se 'l mare fosse tocio e i monti de polenta,

If the sea were sauce and mountains polenta,

oh mama che tociade, o mama che tociade.

oh mama, what dippings, oh mama, what dippings.

Se 'l mare fosse tocio e i monti de polenta,

If the sea were sauce and mountains polenta,

oh mama che tociade, polenta e baccalà.

oh mama, what dippings. polenta e baccalà.

Torricelli, Pascal, Boyle, and - last but not least, Archimedes - sing the song multiple times until rules about noise in Paradise force them to stop.

*****

The sudden arrival of Berenice woke up Professor Baragatti. "It stinks in here," cried Berenice, who proceeded to open all doors and windows, followed by turning on all the fans in the house, as well as a huge air purifier that had been acquired at the height of the pandemic.

"What smell, I do not smell anything," shrugged Gianluca, who proceeded to stir the pot of *baccalà*. Then he went to his desk to work out the solution to Torricelli's quiz. Eventually, after much labor, he thought he got the right answers, but he is waiting for confirmation from some physicist friends.

While waiting for that response, he enjoyed the *baccalà,* which Berenice refused to eat but was heartily appreciated by his daughter Vanessa.

Solution for baccalá quiz

Length of tube: 100 cm

External diameter: 1 cm

Internal diameter: .8 cm

Density of glass: 2.5 grams/cm^3

h = length of mercury column (cm), positive or negative

Density of mercury: 13.6 grams/cm^3

s = length of submerged section (cm), always positive

We assume, as done previously, that Boyle's law is valid and that there is no solubility of air in mercury.

Given s, the amount of submersion, we can calculate h, the height of the column, as the solution of a quadratic equation (see previous solution). Once we know h, the force on the barometer is the sum of three terms:

Atmospheric component (due to difference in pressure at top and bottom of tube, directed down if h is positive, directed up if h is negative)

$F_{atm} = -\pi\ (.8/2)^2\ (cm^2) \times h\ (cm) \times 13.6\ (g/cm^3) \times .0098\ (N/g) = -.06699\ h$

Component due to weight of tube (directed down)

$F_w = -\ \pi\ [(1/2)^2 - (.8/2)^2]\ (cm^2) \times 100\ (cm) \times 2.5\ (g/cm^3) \times .0098\ (N/g) = -.693\ N$

Component due to Archimedes buoyancy (directed up)

$F_A = \pi\ [(1/2)^2 - (.8/2)^2]\ (cm^2) \times s\ (cm) \times 13.6\ (g/cm^3) \times .0098\ (N/g) = .0377\ s$

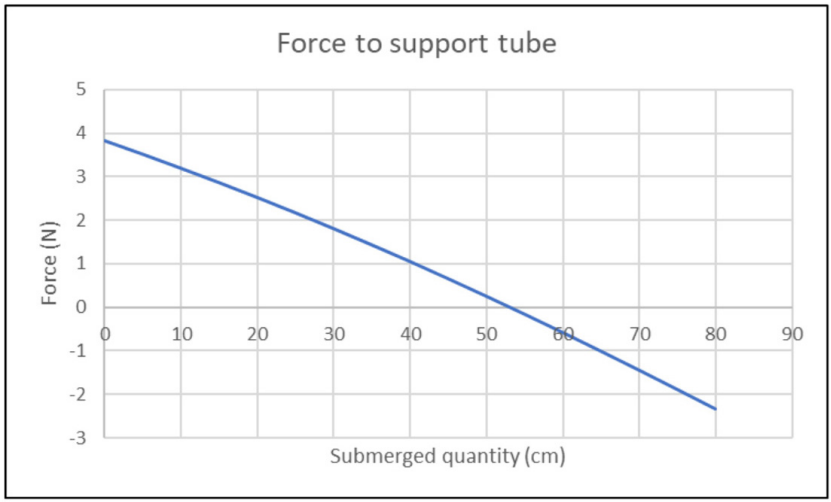
The force F needed to support the tube is $F = -F_{atm} - F_w - F_A$

For s=5 cm h=45cm F= 3.52 N; For s=40 cm h =27.83 cm F = 1.05 N

Therefore, the correct solution to the first part of the quiz is 1b.

The plot below shows the behavior of F versus s. The tube should float when it is immersed about 53 cm.

Therefore, the correct solution for the second part of the quiz is 2c.



The Great Mexican Glass Experiment

Professor Gianluca Baragatti was standing next to the kitchen sink while holding a cylindrical blue rimmed Mexican glass. It would have made a lot of sense if he had been drinking beer out of it, but instead he was holding it in a reverse position and pushing it up and down into a large bowl full of water, while mumbling something.

“Are you talking to a glass?” asked his wife Berenice. “No, no, just talking to myself to better understand what I am doing,” replied Gianluca defensively. But he continued to explain to the glass what he had in mind.

What was triggering this strange behavior was the fact that Professor Baragatti had recently experienced a couple of weird happenings. While pausing during the preparation of a special dish, he twice had fallen into a light sleep. During these naps, famous scientists from the past had appeared to him and had challenged each other to solve quizzes involving how a mercury barometer would respond to progressive immersion. Upon waking up, Gianluca had gone to his desk and had tried to find the solution to the quizzes.

In the first instance, the dish was roasted turkey and the quiz involved the variation of the mercury level with the depth of immersion of the barometer. Gianluca managed to get a solution, which involved solving a quadratic equation.

The second time, the dish was baccalá and the quiz involved the force needed to keep the barometer in place at different positions. This time he had a harder time, mainly because he lacked a good feeling for the practical effects of hydrostatics. Just imagine that you are keeping a barometer partially immersed in a mercury vessel. Should you push it down to prevent it from coming up? Should you hold it up from keeping it from sinking? The answer depends on different forces due to the atmosphere, the amount of air in the barometer, the weight of the tube, and the Archimedes buoyancy. And, if you were trying to calculate that force, should you explicitly include the pressure from the contained air? Professor Baragatti found a solution based on what he remembered from his old studies, but, frankly, he was not totally certain of its correctness.

That is why he thought of carrying out an experiment that would illustrate the situation. Lacking a thin glass tube, as well as mercury, he thought of using a glass, specifically a long, blue rimmed Mexican style glass, to be immersed in water in an inverted position. He imagined that the glass would probably be unwilling to cooperate. After all, a proud straight Mexican glass, used to hold beer, could be worried about its image being tarnished by the *inversion* part, which could easily be misinterpreted by its fellow glasses. Gianluca imagined that explaining to the glass the objective of his experiment would facilitate its success.

“See, now I am holding you in an inverted position and I approach the surface of the water. You are full of air at standard pressure. As we begin submersion that air is lightly compressed and it also pushes down some water. The force necessary to support you is directed upwards (pull). Continuing the immersion, we reach a point where you start to float. At this position you seem to be unstable and you need to be supported laterally in order not to tip over. From this point on the force needed to keep you in position is directed down (push). Now I tilt you until you make a noisy burp which lets out a bubble of air. You did not apologize for the burp, instead sinking down more, and reaching a stable floating position which does not require the support of my hand anymore. This should be a lesson for people, especially politicians: if you get rid of the air, especially hot air, you will be more stable. Now, when I start lifting you out of the water, I reach a point where a liquid column starts forming, after which the air pressure decreases, and the necessary holding force keeps increasing. These are qualitative observations, but it should be possible to measure the force as a function of the amount of submersion. This function will depend on the amount of air trapped in the glass. Measuring this function is what I

intend to do."

Professor Baragatti started preparing his experiment and, while doing this, he seemed to be enjoying himself. "He looks very happy," commented his daughter Vanessa, "he looks like a two-year-old."

"Do not knock it," said Gianluca, "if it helps taking away eighty years of age, it must be working."

Figure 1

Actually, two separate implementations of the experiment were con-ducted. In the first instance a dog's water bowl and a stool that had prominently figured in a previous Christmas story were used, plus a kitchen digital scale and a ruler. The glass was hanging from a nylon wire that went over two pulleys and ended supporting a counterbalance. A set of drawer knobs left over from a previous remodeling job was used to lift the glass out of the water. Weight had to be added on top of the glass after reaching the floating position. Also, the glass had to be supported laterally to prevent instability. The experimental setup is shown in Figure 1.

In the second instance the glass was suspended over a sink and constrained within three wooden guides, so it would not tip over, and the force was measured with a dynamometer attached to a wooden beam that was supported by cases of beer. "The glass must be happy about this last feature," thought Gianluca. The setup is illustrated in Figure 2.

The results of both theory and experiment are illustrated on the following pages. The agreement obtained made Professor Baragatti feel confident that the calculated results for the mercury barometer were correct, since the same methodology was used in both cases.

After the experiments were done, Professor Baragatti realized that there were sources of error, mainly due to friction of the wire over the pulleys,

and to friction of the glass against the guides. However, sanity and budget constraints ruled out further experimentation.

Considering the crudeness of the experiments, the observed discrepancies are not very significant. *At least good enough for government work*, as Dr. Greeninski, Gianluca's former coworker, used to say. However, a much bigger discrepancy existed between Professor Baragatti's perception of the amount of time he spent on this project (trivial) and his wife Berenice's perception of it (immense).

Figure 2

Mexican Glass Experiment Data and Results

Length of glass: 12.5 cm

External diameter: 8.19 cm

Internal diameter: 7.09 cm

Weight: 400 grams

Density of glass: 2.05 grams/cm^3

h = length of water column (cm), positive or negative

Density of water: 1.0 grams/cm^3

s = length of submerged section(cm), always positive

We assume, as done previously, that Boyle's law is valid and that there is no air trapped in water.

Given s, the amount of submersion, we can calculate h, the height of the column, as the solution of a quadratic equation (see previous solution). Once we know h, the force on the glass is the sum of three terms:

Atmospheric component (due to difference in pressure at top and bottom of glass, directed down if h is positive, directed up if h is negative)

$Fatm = -\pi\ (7.09/2)^2\ (cm^2) \times h\ (cm) \times 1.0\ (g/cm^3) \times .0098\ (N/g) = -.387\ (N/cm)\ h\ (cm)$

Component due to weight of glass (directed down)

$Fw = 400\ (g) \times .0098\ (N/g) = -3.92\ (N)$

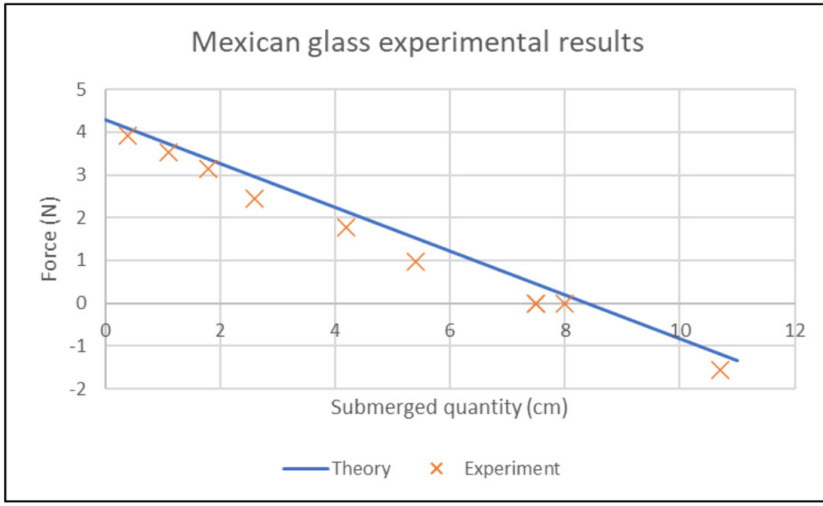
Component due to Archimedes buoyancy (directed up)

$FA = \pi\ [(8.19/2)^2 - (7.09/2)^2]\ (cm^2) \times s\ (cm) \times 1.0\ (g/cm^3) \times .0098\ (N/g) = .129\ (N/cm)\ s\ (cm)$

The force F needed to support the glass is F = -Fatm - Fw - FA

The initial condition for the experiment was estimated to be s = 4 cm, h = -3 cm. The s(h) function obtained solving the quadratic equation is illustrated in the figure below, showing that the glass floats for s equal to about 8.3 cm. This was verified experimentally.

Data obtained measuring the force at different values of s are shown in the figure as crosses.


Mexican glass experimental results
Force (N)
5
4
3
2
1
0
-1
-2
0
2
4
6
8
10
12
Submerged quantity (cm)
Theory
Experiment

QUINTA GIORNATA (FIFTH DAY)
STORIES CONNECTED
WITH MODERN PHYSICS

The stories narrated during this day are somewhat related to modern physics, such as quantum theory. Can you learn quantum physics from these stories? Definitely not! In some cases there is a direct connection to quantum theory, in other cases the reference is to people who are somehow connected to it, such as scientists, professors and so on. In any case an effort has been made to maintain energy and momentum conservation, without which no moral purpose could even be claimed. And of course, just like the other stories, they contribute to the unity of the book by having a connection, direct or indirect, to some aspects of the world of physics.

The tunneling effect and Greek mythology. Quantum theory helps in solving a crime in Italy at the time of Mussolini. A train against a pea according to relativity. Quantum underwear. These stories and others are narrated during this day.

The Band Theory

As soon as Margaretha saw Marcello she knew that he had to be some kind of artist in the music field, maybe a singer or a player in a musical group. Being a fan, some would say a fanatic, of modern music for young people, she could tell from Marcello's clothes, his hair, and his hands where his interest would be and what his professional activity most likely would be.

Margaretha was a young Swedish girl who had come with her friend Birgitta to spend two weeks in Rimini, a resort town on the Italian Adriatic Riviera, a relatively cheap place whose population in summer reaches six figures. The town is deservedly famous for its nightlife and also for the good food of the Emilia Romagna region.

Margaretha and Birgitta were now sitting at a table in La Perla, a rather unsophisticated night club or discotheque in Rimini. They were sipping rum and coke, which was a novelty in those days, and were carefully assessing the population of the site, which was mostly composed of lower class young Italian men looking for the opposite sex. The music was very

loud, and the two young women wanted to play it safe and had discreetly declined a number of advances.

Marcello and his friend were sitting at the opposite side of where the girls were located and seemed involved in an animated discussion. Occasionally they were scribbling something on a piece of paper. Because of the distance and the music, the girls could not hear anything that the young men were saying. In spite of the musical appearance which had aroused Margaretha's interest, Marcello had an intellectual air that was not easily found in the average population of the discotheque.

At one point, Birgitta decided to go to the powder room and in doing so she went slowly by the table where the two young men were sitting. When she came back, she said: "With all the noise and my limited knowledge of Italian, the only words I was able to catch were … *banda* … *metallo* … *teoria* …."

"I knew all along that I was right," said Margaretha, her eyes shining. "He must be playing in a rock band, most likely hard metal, or heavy metal, or classic metal. As for *teoria*, he must surely be referring to the fashion line Theory which we know well from the department store on Kungsgatan in Stockholm. That is a plus and shows that he has a sophisticated taste. Let us get some more rum and coke."

"Agreed," said Birgitta.

As the evening proceeded there was some mixing, and the two girls somehow managed to start a conversation with the two young men. And here a disappointment was in store for Margaretha.

*****

"Signorina," said Marcello, "I am not a musician, and you should be able to tell by the horrible way in which I dance, for which I apologize. A long time ago my parents paid for some violin lessons, but that did not last long, I did not have any talent in that field, and the neighbors complained about the weird sounds I was making with the instrument."

"No, signorina," he continued, "I am only a student of physics and with my friend I am preparing for an exam. I am sure you know nothing about this, but electrons in metals are quite free, and they arrange themselves in energy bands, conduction bands, valence bands, so there is a band theory. Controlling the jumps from one band to the other is the art and science of semiconductors, and that is the foundation of electronics, which is mostly

responsible for the music you are hearing right now."

Margaretha was at first very disappointed. *He must be a square, a nerd. He probably does not have any common sense*, she thought. But then, as the evening proceeded, she felt that perhaps there was some poetry in what he had said and the way he had said it.

Margaretha and Marcello became friends and spent some of the time that the Swedish girls had left in Rimini together. As to what they did during that time, we have no right to know.

A Roman Mystery

It was sometime in the 1930s. Enrico Fermi and Niels Bohr were walking down the Old Appian Way in Rome, discussing some aspects of what would later become known as the Copenhagen interpretation. At some point in their walk they had encountered a huge sign spelling out one of Mussolini's famous phrases:

È L'ARATRO CHE TRACCIA IL SOLCO
MA È LA SPADA CHE LO DIFENDE

Bohr got hold of his small Danish-Italian pocket dic-tionary and, after telling Fermi, "Let me figure it out," began the translation. After a short time, he said, "It is the plow that digs the furrow, but it is the sword that defends it," and he looked at Fermi for confirmation. "That is perfect, Professor Bohr," said Fermi. "It seems to me," added Bohr after some thought, "that Mussolini wants to have more farmers and more soldiers."

Enrico Fermi and Niels Bohr
in a discussion during a walk
along the Appian Way in 1931

After a while, their curiosity was aroused by a circle of people who were watching some goings on, while being kept at a distance by police officers. There were a number of police cars (not the black and white cruisers that we see on TV today, but an assortment of Lancias, Fiats, even an Isotta Fraschini) and the authorities were busy taking photos and measuring things.

As the two scientists approached, Fermi recognized one of his neighbors from the building where he used to live before moving to Via Nomentana. Inspector dePaolis recognized Fermi too and came over to him. He was an old-style Neapolitan, with impeccable manners and class, who had managed to maintain his sense of humor and intellectual honesty under the harsh conditions of the fascist regime.

“Professor Fermi, I am glad that you and your distinguished guest are able to enjoy a stroll on Via Appia Antica. Unluckily I am here because of my duties and of unfortunate circumstances,” said dePaolis.

A body had been found near some ancient ruins, and dePaolis had come to oversee the investigation. Although he probably should not have done so, dePaolis mentioned that the only clue left on the body was a card with some cryptic symbols on it, most likely a code used by criminals and anarchists. The code was similar to a message that had been found previously on another body, but, in spite of considerable investment made by the regime in counterespionage technology, no one had any idea of the meaning of those symbols. Fermi was intrigued, we work with symbols

too, you know. Well, here it is. DePaolis had copied both messages on a piece of paper that he was holding. As he showed it, he could immediately see Fermi's surprised reaction. "Then you know what this means," he inquired. "Well, yes, up to a point." "In that case, my dear Professor, you should come with us downtown, and we should talk about it over an espresso."

*****

Niels Bohr was puzzled. He obviously could not follow the arguments in Italian. Now he and his host were sitting in the Commissariato of Zona San Giovanni, waiting for a debriefing. "Are we being suspected of the crime already?" he asked Fermi. After all, this was Mussolini's Italy. "Do not worry, Professor Bohr," said Fermi. After all, this was still Italy.

*****

As they had entered the building, they had gone through a long hall where several people were waiting. In one corner sat an old lady with a headband and a gypsy appearance. As they had gone by, she had given a long penetrating stare to Fermi. "That is Madame Giralda," said dePaolis. "She is a medium and occasionally we employ her in cases like this. Her predictions are right about seventy percent of the time. Actually, I think she could be right one hundred percent of the time, but I believe that in political cases she deliberately points us, I mean them (he had lowered his voice), in the wrong direction." They sat down in the inspector's office.

After sipping the espresso, dePaolis got down to business. Apparently, a body had been found the previous week in Trastevere, with a card containing the following message:

$$a|7\rangle = \sqrt{7}|6\rangle$$

while the body just found carried a somewhat similar message:

$$a|6\rangle = \sqrt{6}|5\rangle$$

"OK, professor, what does this mean to you?" started dePaolis. "My dear Inspector, I am afraid that you are dealing with a serial killer," Fermi began. "I shall try to explain in simple terms what this means to me. To begin with, the notation $|\ \rangle$ has been introduced only very recently by Dirac, an English physicist who is smarter than almost everybody else."

“In principle, every system, from a subatomic particle to a beautiful woman, can be described by what we call a state vector, which is symbolically represented, for example, as $|5\rangle$, to indicate that the system is in state P. This approach is useful for atoms and subatomic particles, but not for large systems such as beautiful women. We cannot put our hands on, or measure these states; however, in the cases where the approach is useful, we can calculate probabilities of transition from one state to another.”

“The states are related to each other, or modified, by mathematical entities that we call operators. In a very special but important application, the state can be represented by the number of quanta in it. When you apply to this state the annihilation operator a, you effectively destroy one quantum. Therefore

$$a|n\rangle = \sqrt{n}|n-1\rangle$$

The square root factor has to do with the probability of transition from state $|n\rangle$ to state $|n-1\rangle$ and we should not worry about it now. My theory is that your killer somehow thinks of himself as an annihilation operator, and is determined to kill seven people, which he sees as quanta in an initial state. I should also mention that we also use a creation operator, $a^\dagger$, which behaves in the opposite way, and increases by one the number of quanta in the state.”

$$a^\dagger|n\rangle = \sqrt{n+1}|n+1\rangle$$

“Someday I shall make an effort to really understand all this,” said dePaolis. “For the time being, Professor, I thank you very much for the private lecture. Rest assured that we shall make any effort to catch this character before he operates again.”

On their way to the exit, dePaolis had asked Fermi, would it be dangerous if this annihilation operator were to fall in the hands of anarchists, such as those presently operating in Barcelona, to which Fermi had answered: “Do not worry, Inspector, these are tools that we only use for thought experiments.” He had pronounced these words as they were passing in front of Madame Giralda. The old woman raised her head and said to him, “Some thought experiments. Just like the one you will be carrying out in Chicago, is that going to be a thought experiment too?” Fermi was puzzled. “Excuse me?” “Oh, never mind,” said Madame Giralda.

*****

The information that Fermi had provided was indeed very valuable. Inspector dePaolis and his men were used to doing diligent police work. They now knew that they should focus on a very small community, especially since Dirac's book had been published only a year before. Surely the perpetrator of the crimes must have had some connection with theoretical physics. In the next few days, dePaolis' men interviewed many students and teachers at the Department of Physics of the University of Rome, and in a relatively short time were able to make their suspicions converge on a man by the name of Ricciotti, who for a while had been a student of both theology and physics.

He had absorbed some superficial knowledge about both subjects and was known for always trying to find relationships (metaphors, he called them) between quantum mechanical concepts and aspects of human life. When the police went to his address, they found a stack of cards, each one with an equation describing the successive application of the annihilation operator from state $|5\rangle$ down to state $|0\rangle$. So, the case was solved, and five innocent lives were saved.

*****

Two years later an infant was found at the front gate of the Convent of San Francesco in Naples. The only clue on the baby was a card containing the following cryptic message:

$$a^{\dagger}|0\rangle = \sqrt{1}|1\rangle$$

This fact eventually came to the attention of Inspector dePaolis, who, being a smart man, immediately understood its significance. Since he wanted confirmation, he called Fermi. "Professor, would that be an example of application of the creation operator?" "My dear inspector, you are a fast learner," was the answer.

There are two conclusions that can be drawn from this particular event. The first conclusion is that a baby boom had begun, in response to Mussolini's desire for more farmers and soldiers. The second conclusion is that knowledge of quantum mechanics was indeed spreading in Italy in the 1930s.

A Quantum Pasta Policy

Pasta in the United States is usually sold in one-pound packages. Even some pasta that comes from Italy is packaged that way, a concession to a people that have rejected using the metric system. Be it as it may, Professor Gianluca Baragatti was reflecting on the way he and his wife Berenice were using the pasta packages. Many years before, when his daughters were home, one full package, or one pound, of spaghetti, rigatoni, penne, whatever, would be dropped in a boiling pot. After the kids moved away, Gianluca and Berenice started using one half of a package every time they made pasta. This went on for a number of years, until Gianluca, worried about gaining too much weight, proposed a change of policy using only one third of a package for their meal. The average portion would decrease from about 113 grams to about 76 grams, and the new policy was approved enthusiastically by Berenice who often complained about the excess amount of pasta that needed to be either consumed or discarded.

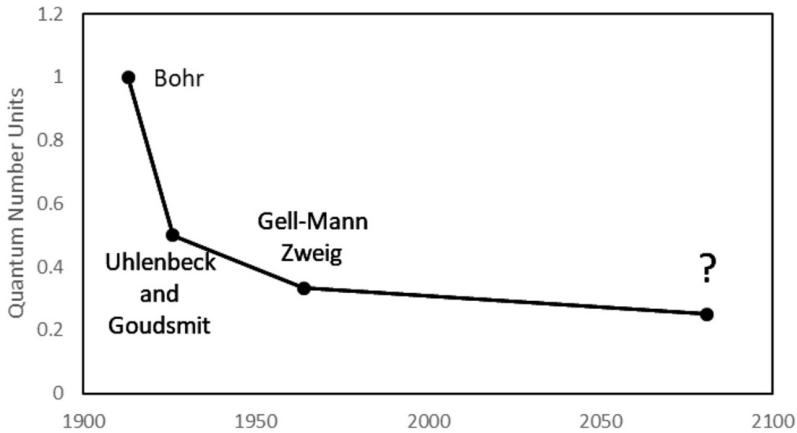
The fact that the time evolution of the consumption of pasta in the Baragatti family involved the sequence

$$1,\ 1/2,\ 1/3,$$

intrigued Gianluca and got him thinking. Where had he seen the same pattern?

The answer came to him while he was finishing his reduced portion of bucatini. Quantum theory! One aspect of quantum theory is the presence of discrete quantities, often characterized by so called quantum numbers. In 1913 Niels Bohr introduced his model for the hydrogen atom, which used only **integer** quantum numbers, and for many years people tried to interpret atomic spectra using **integer** numbers, with limited success. In 1925 there was a major revolution, when Uhlenbeck and Goudsmit discovered the electron spin, which resulted in the introduction of **half-integer** quantum numbers. And then, in 1964, Gell-Mann and Zweig independently proposed the idea of quarks, which have an electrical charge in units of **1/3** of the electron charge. So, the sequence 1, 1/2, 1/3 does indeed appear in the history of quantum theory.

Now, about thirteen years went by between the 1 and the 1/2 discoveries. And about thirty-nine years, or three times more, went by between the 1/2 and the 1/3 discoveries. Thus, if this tradition were to continue, about one hundred and seventeen years would go by before someone would introduce quantum numbers in units of 1/4. That would happen somewhere around 2080.



Professor Baragatti did not expect to live until that time and felt a sense of relief, since he was not prepared to use only 1/4 of the package and to cut down his portion of pasta to 57 grams. But, just to be safe, he did not share his quantum number extrapolations with Berenice.

Quantum Underwear

Many years ago, Professor Socrates Decherkionis was part of the faculty at the Institute of Physics at the University of Athens (Athens, Greece - not Georgia or Ohio). He was well respected, since he had published a number of papers on the subject of quantum field theory and he had received very positive comments within the very limited community of people that understood such things. For some reason, conscious or unconscious, he seemed to associate more with people who had not only recognizable first names, such as historical names, but also names of characters who had been, or could have been, interacting with his famous namesake. For example, his best friends were named Alcibiades and Themistocles, and his favorite student was named Plato.

Thus, people were not surprised when Professor Socrates Decherkionis married Xanthippe Pollolokos. “Socrates,” said the most compassionates of his friends, “must have labored hard to find a woman with that name.” Others were less sympathetic and thought: “This is a marriage based on sarcasm.” Socrates’ friend Alcibiades said: “I do not think that she will empty a chamber pot on his head,” to which Themistocles replied: “Of course not, nobody ever uses chamber pots anymore!”

Xanthippe emptying a chamber pot over Socrates, from *Emblemata Horatiana* illustrated by Otho Vaenius, 1607

Be it as it may, and to the surprise of many, the marriage was a great success. Xanthippe turned out to be the sweetest and most devoted wife, and the couple enjoyed many years of marital bliss. They were often seen walking hand in hand and smiling at each other.

Except. Or should I say until. Until Professor Socrates Decherkionis retired, and years kept adding on. Gradually Xanthippe, who was getting older too, started complaining about certain ways of her husband that she did not particularly approve of. To this criticism Socrates always replied with justifications that involved principles of physics.

For example, if Xanthippe complained because her husband was doing nothing all day, maybe sitting in front of a computer, while she was slaving away cleaning the house and cooking, he would say: “That is because of the principle of inertia,” and would try to give her a lesson on classical mechanics and so on.

If Xanthippe complained about the mess on his desk, he would say: “That is because the entropy in the universe always increases, and so does disorder,” and he would try to give her a lesson on thermodynamics and so on.

When Xanthippe complained because he was peeing outside the toilet bowl, he said: “That is because of the principle of uncertainty,” and tried to

give her a lesson on quantum theory and so on.

And lastly, when Xanthippe had carefully set up clean underwear for her husband to change into after taking a shower, and he absent mindedly had put on the unwashed ones, he said: “These things are like quantum objects, they must be undistinguishable.” And to some extent he had a point here, because Xanthippe was a compulsive cleaner, and every piece of clothing that fell on her hands, clean or dirty, would inevitably quickly make its way into the washing machine.

This last episode came to the attention of Socrates’ friends. Alcibiades and Themistocles teased him repeatedly and declared that he had quantum underpants. Eventually this knowledge reached the university, and with time became part of the truths and untruths that are associated with the folklore of great institutions. Long afterward, students somehow came to learn that in previous years a character nicknamed Quantum Underwear or Quantum Underpants had been teaching physics there. And because of the nickname some also came to believe that there was a sexual connotation attached. So, the legend was created, and, regrettably, this was the legacy of Professor Socrates Decherkionis.

The Columbus’ Egg of Quantum Mechanics

“And that is what is known as the egg of Columbus,” said Professor Gianluca Baragatti, obviously very proud of himself, after making an egg stand up on the dining table. His wife Berenice just rolled her eyes, as she had done many times on similar occasions. In Italy everybody knows what you mean when you refer to a situation as a *uovo di Colombo*. However, chances are that use of an equivalent expression in the United States will get you a blank stare in return. Because of this, when Professor Baragatti had new people over for dinner he always managed to introduce a reference to Columbus’ egg as part of the conversation (except when his guests were Italians, obviously). Once it was clear that his guests were unaware of the term, he would proceed with a demonstration. Which, inevitably, caused Berenice to roll her eyes. Since some of you may also be unfamiliar with the subject, we are providing a brief description of it. Incidentally, if you search for *egg of Columbus* on Google, you will find that the concept is known, as it should be, worldwide.

An egg of Columbus (or Columbus' egg) is a metaphor for an ingenious

idea or discovery that seems simple or easy after it has been uncovered. The expression comes from an apocryphal story, dating from about the 15th century, in which it is said that Christopher Columbus, having been told that if a new trade route were feasible, it would have already been found, challenged his critics to make an egg stand on its tip. After his challengers gave up, Columbus did it himself by tapping the egg on the table to flatten its tip. The story is often mentioned when discussing creativity. It also shows that anything can be accomplished by anyone with the right set of skills; however, not everyone knows how to do it, at least immediately.

1752 Engraving by William Hogarth

Monument to the discovery of America by Columbus in the shape of an egg in Sant Antoni de Portmany, Ibiza, Spain

In any case, the correlation between Columbus and the egg is illustrated by a monument erected in Spain to honor the discovery of America. It is shaped as - what else? - a flattened egg. That seems like a great idea, since it would minimize the chance that individuals protesting the great navigator would vandalize the statue, perhaps out of respect for Humpty Dumpty, who was probably pushed off the wall by police brutality. All the king's horses and all the king's men tried to cover up the attack, but were unsuccessful, since they could not put him back together. (*)

Gianluca often wandered what would happen if he slammed the egg hard enough to break it and made a horrible mess on Berenice's white linen tablecloth. Would his marriage survive? Hence, he was always very careful to tap the egg just enough to make it stand up. And up to that time the only reaction from Berenice had been just the rolling of her eyes.

*****

In 1925 Werner Heisenberg wrote a paper in which, for the first time, non-commutative multiplication appears (meaning that 'A times B' is not always the same as 'B times A'). As strange as that may have sounded, the theory was effective in predicting quantities that could be measured, such as the frequencies of spectral lines. The idea of non-commutative multiplication made a big impression on Dirac, who shortly after the appearance of Heisenberg's paper, formalized the theory in a paper under the ambitious title *The Fundamental Equations of Quantum Mechanics.*

Professor Gianluca Baragatti wondered if the discovery of non-commutative multiplication could have been a Columbus' egg moment in the development of quantum mechanics. If you think this could not be true, just look at what Albert Einstein wrote to Paul Ehrenfest in a letter dated September 20, 1925: "Heisenberg has laid a big quantum egg." (**)

But just to be clear, the appearance of the new idea could have been a Columbus' egg moment (a brilliant discovery that seems simple or easy after its discovery) to someone like Dirac. To Professor Baragatti and most of the rest of us, it is still a mysterious and intimidating subject.

*****

Another interpretation of the term *Columbus egg* might be that it is a witty solution to a paradox or a guessing game. Consider this: in a small village there is only one barber, who shaves all and only the men in the village who do not shave themselves. How will the barber handle his own personal

shaving? Well, the barber is a woman and does not need to shave. A smart solution to the paradox, and what Professor Baragatti would call, in his native language, *un uovo di Colombo*.

_____

(*) Humpty Dumpty sat on a wall,
Humpty Dumpty had a great fall.
All the king's horses and all the king's men
Couldn't put Humpty together again.

From Mother Goose's Rhymes

(**) Mehra, J and Rechenberg, H. (1982:276) The Historical Development of Quantum Theory, Vol IV, New York, Springer-Verlag.

Tunneling

"Ouch!" screamed Eros, as the arrow that he had sent to the heart of a lovely young woman had come back and hit him in the left shoulder. "Luckily it did not go through my heart, otherwise I would have fallen in love too, which, for a God of Love, would be a serious conflict of interest." Times had been difficult for Eros, as well as for the other Gods. A big reorganization had begun in Olympus, and it would also include changing his name to Cupid. It used to be that his arrows had dramatic effects, but now their effectiveness seemed to have diminished.

Still, he could not understand how one of his arrows could have come back to the point of hitting him. All the models of human hearts pointed to a soft mass into which it was easy to penetrate. Eros could not understand what had happened, so he decided to consult with his father Hephaestus, who was in charge of technology in the Olympus organization.

"How are you doing son?" inquired Hephaestus, "Are you going by the name of Cupid already? As for me, I hate having to change my name to Vulcan."

"I know, but I am here because of a strange effect that has happened with one of my arrows, and I hope you can help me find an explanation for it. You see, the arrow came back and hit me on the arm."

Hephaestus, or Vulcan, thought for a long time and then said: "This is remarkably similar to something that will happen to a guy by the name of

Ernest Rutherford many centuries from now. He will be shooting alpha particles against gold foils, and will notice that some of them come back. From this he will discover the existence of the nucleus, effectively starting a branch of science called nuclear physics. I think that you are experiencing a similar effect. The heart of some women shows similarities to the model of a nucleus, which is extremely hard to penetrate. It may have something to do with that woman Lysistrata and that movement she started."

Lysistrata
Illustration
by Aubrey
Beardsley, 1896

"Good Lord!" said Eros, "What should I do?"

"Well, you can still learn from Rutherford. He was - I mean he will be - a very smart guy. He will have two bright fellows, Cockcroft and Walton, I believe, build him an accelerator. They will use protons, instead of alpha particles, to get into the nucleus. So, I suggest that you use a similar route."

Eros was happy with the new knowledge and thanked his father. Since accelerators require high voltages, he went to see Zeus who was the only one in the organization who was certified to handle lightning and the like. When Eros arrived, Zeus was busy changing all his stationery to the new name of Jupiter, and was happy to devote his attention to a technical problem. He provided Eros with smaller projectiles which were accelerated by electrostatic potentials strategically placed in the clouds, and with these he would be able to enter the heart of even the most impenetrable and unyielding woman.

Rutherford and his coworkers were also aided in their efforts to break up the nucleus by another quantum effect known as tunneling; this also

became known to the mortals at about the same time of the other discoveries. Thankfully this offered some humans a path to love that didn't require Eros' experimental projectiles.

Tunneling allows one to enter into (or escape from) a barrier, even if one has less energy than what is needed to break the barrier. Incidentally, that is how smugglers manage to get drugs and trafficked women across border walls. Often, the work of Eros goes on behind closed doors, and it appears to us as if any eventual success in entering the heart of a woman is the consequence of a number of tricks or tunneling acts. Literature is full of examples in which the heart of a woman was won through tunneling, a major case being that of a Chinese princess, as faithfully documented in Puccini's opera Turandot.

Where the male gender is concerned, however, there is a general consensus that the most effective tunneling to a man's heart is through his stomach, as supported by a well-known proverb.

Cone of Causality

Professor Gianluca Baragatti and his wife Berenice were standing outside the Good Samaritan Veterinary Hospital. They were waiting for their dog Gengis to be released from the clinic. The canine had been affected by gingivitis, a condition which had turned into an ugly abscess requiring urgent medical care. Because of a current pandemic (or the perception of it, depending on your political orientation), Gianluca and Berenice were wearing masks and were supposed to wait outside. Finally, an employee of the clinic who was dressed like an astronaut came out leading Gengis, who had a transparent plastic cone around her neck, apparently to prevent her from scratching herself in the area where she had been medicated.

Gengis the dog

“I see that you put a cone of causality around her neck,” said Gianluca. This must have caused a puzzled look on the face of the employee, but you could not tell because of the face masking.

“Some people call it a cone of light,” added Gianluca.

“Excuse me?” inquired the astronaut.

“Never mind my husband,” said Berenice. “Sometimes he says things that do not make any sense.”

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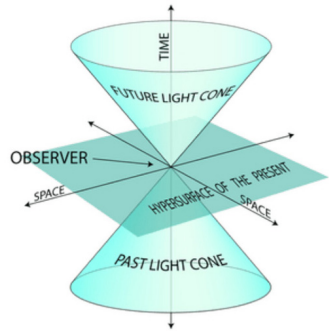
Professor Baragatti and Berenice took Gengis home, where she started on a speedy recovery. “I know that the clinic charged an arm and a leg for the treatment,” said Berenice, “but it was not necessary to make astronomical references.”

“Nothing to do with astronomy, just special relativity,” explained Gianluca.

The cone of causality, which is actually a double cone in four dimensions, divides spacetime into the causally connected future, the causally connected past, and elsewhere. For the purpose of this story, you do not have to understand all that. The single relevant thing is that events within the cone can cause or affect other events within the cone, but events elsewhere, or outside the cone, cannot cause or affect events inside the cone.



Cone of causality

Professor Baragatti was also reminded of the cone of causality because of what had taken place fifteen years earlier, in 2005. That year, which marked 100 years since Einstein had introduced special relativity in 1905, had been internationally declared the Year of Physics. Therefore, Gianluca had instigated a special exhibit at the local science museum to celebrate Einstein and the centennial of special relativity. This was a marvelous occasion for organizing fundraising dinners to support the exhibit, which ran for a year and was very successful. Berenice played a big role in organizing the fundraising events. On that occasion Gianluca, with the help of two smart engineers, had built a number of displays illustrating the relativity of simultaneity and other concepts and paradoxes from that theory. In some of the displays the cone of causality was represented and had a strong similarity to the gadget that had now been placed around Gengis' neck.

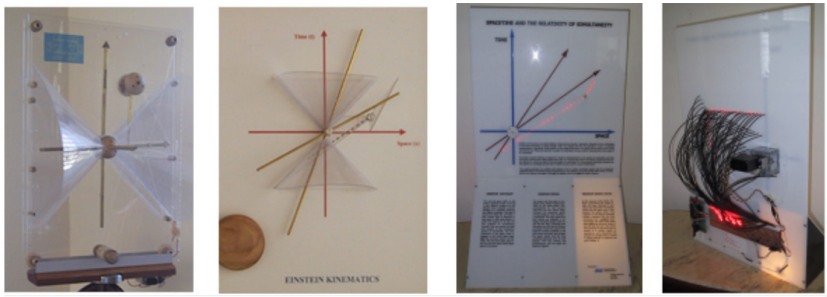
"When you think about it," mused Gianluca, "a mosquito outside the cone cannot bite Gengis on the cheek. And as long as her paw is outside the cone it cannot cause any scratch on the medicated area, which is inside the cone. So, calling it a cone of causality is not so farfetched after all."

"Well," said Berenice, "you must have an invisible cone of causality or whatever you call it around your neck, judging from the fact that many of the things that are going on around you do not seem to cause any appreciable effect on you. Most of the times you do not even notice them."

"That is possible," admitted Gianluca.

"But on second thought," added Berenice, "that cone must be a very selective one. You would instantly notice a plate of *tagliatelle ai funghi porcini* outside of the cone. And I bet if an attractive woman were to go by

outside of that cone, she would also cause some reaction. Although, at your age, that reaction would be limited to what you guys call, I believe, a thought experiment."



Models illustrating special relativity concepts, including the cone of causality

A Train and Pea Story

Professor Gianluca Baragatti picked up a physics book from his bookcase. The book had been in his possession for nearly sixty years, since the time he was at the university. The book was mostly about cosmic rays and highly energetic particles, and Gianluca had not looked at it in a long time. It is safe to say that that he had forgotten almost everything about it. So, he started to read the first chapter which deals with particle collisions. After a few reasonable equations, he found the following paragraph:

> This result, unlike that of nonrelativistic mechanics, indicates that a particle of very high energy can transfer almost all of its kinetic energy to an electron even if the mass of the particle is much larger than the electron mass. Thus a very-high-energy meson or proton can be practically "stopped" by a head-on collision with an electron.

The first sentence in the paragraph above is correct. The second one implies that a particle (electron), when hit head-on by another (proton) that travels at very high speed and weighs almost 2,000 times more, can essentially stop it. If this were true, thought Gianluca, in principle a pea could essentially stop a train, as long as the train were going at a relativistic speed. Could this be true? Professor Baragatti was intrigued by the question and started to do some calculations to verify it. Actually, the calculations are not that complex, but Gianluca was so rusty with algebra, and he made

so many mistakes, that he was in danger of running out of paper. This seriously worried his wife Berenice and his daughter Vanessa, who were afraid that he might eventually start scribbling equations on toilet paper, a commodity of high scarcity in recent pandemic times. It turned out that was not necessary, because Gianluca started communicating with an old university colleague of his, a retired professor of physics whose last name matches that of a famous Italian wine area. Professor Chianti (this was his name) quickly found a very elegant graphic solution for the problem, which clearly showed that the heavy particle, object, whatever, in a collision with a much lighter thing, while it could lose 99 percent or more of its kinetic energy, would keep a substantial part of its velocity (something, by the way, not possible according to classical mechanics). Thus, unfortunately, a pea cannot stop a train, not even in principle. As an aside, Berenice and Vanessa, who were used to communicating virtually with the world-at-large using the latest of gadgetry and app-ology tools, felt that the e-mail exchanges between Baragatti and Chianti, which consisted mostly of scanned pages of equations and graphs, were an extreme example of nerd interaction.

In the old days, when something was written in a book, we tended to believe it. Of course, there was less fake news going around. So, in the 50s and 60s, other people who had studied the above-mentioned book must have been convinced of the truth of the stopping power of light entities, as demonstrated by the totally unrelated but partially true story below.

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Physicists have been known to have a sense of humor, some more than others. For example, Richard Feynman has inarguably remained famous for his digressions from academic seriousness. Other scientists who became known the world over, and even some who won Nobel prizes, are also remembered for their occasional levity. A case in point is what took place in Copenhagen in April 1932. At that time Copenhagen was one of the centers of development of quantum theory. And because of the personality of Niels Bohr, Copenhagen had also become a magnet for the best young physicists from many different countries. Every year Bohr invited young physicists to Copenhagen for a gathering where they could talk, joke, and trade theories. It must have been the younger scientists that decided to produce a skit, to be presented at the end of the conference, that would include a mixture of elusive particles that had just been discovered as well as the people who were trying to figure them out. Since 1932 was the

centenary of the death of Wolfgang Goethe, they decided to make the skit a parody of his immortal opus Faust, in which Bohr would be God, Pauli would represent Mephistopheles, and the neutrino would be the innocent Margarethe. It was a hilarious play, and the full story, together with a lot of science insights, can be found in the book "Faust in Copenhagen' by Gino Segrè, a professor of physics at Penn State University and a nephew of Emilio Segrè, who won the Nobel prize for discovering the antiproton. The Copenhagen story is true, the next one is not.

In 1958, at the University of X, students of physics decided to do something similar to what had taken place at Copenhagen and produce a skit. Since one of the instigators was a fan of opera music and it was the centenary of the birth of Puccini, it was decided to make a parody of the opera Turandot. Turandot was a Chinese princess of incredible beauty and awful character, who would insist that any man who wanted to marry her had to solve three riddles. If he failed, he would be put to death. Why anyone would want to marry someone like that is inconceivable, but the costumes and the music in the opera are beautiful, and that is what counts. In any case, the students at X engaged Mary W to play the part of Turandot. Mary W was arguably the prettiest girl on campus. The first one that would be able to answer the three riddles would get to go on a date with her. And the ones who did not answer correctly would be subjected to some mocking, in line with what was going on in those years in the student fraternities. The riddles, of course, would be based on physics, and the potential competitors were to be kept away during the play, so they would not know the questions.

Only three young men were interested enough in a date with Mary W to risk ridiculing themselves. The first one did not know the answer to the first question. The second competitor was Antony Girotti, of Italian heritage. He correctly answered the first two questions and was then faced with the third riddle, that went like this:

"Under what conditions can a pea stop or almost stop a train?"

Antony did not know, but he was resourceful, so he asked: "Can this thought experiment, since it is obviously what it will amount to, be conducted in Italy?"

"The laws of physics do not change with a translation or a rotation of the system of coordinates," said assistant professor Thomas G who was monitoring the event for scientific correctness. "So, you can assume it is

conducted anywhere."

"Well then," said Antony, "here in the US when we say 'pea' we mean the little sphere that goes into a soup, but in Italian, pea translates as *pisello*, and when you say *'pisello'* people usually mean the pod that contains the little spheres. Not only that, but *pisello* is also one of the hundreds of names that the Italians use informally for the male member. So, I can picture a condition in which a female engineer driving a train into Milan station sees a pervert exposing himself, gets shocked, and slams on the brakes. In my mind, that would be a condition for a pea stopping a train."

"In your dirty mind, that is. We are impressed by your ingenuity, which is more appropriate for a Decameron-like story than for the sanctity and seriousness of this University, but that is not the right answer."

The third candidate was a nerd who knew more about physics than most of the University staff. After easily answering the first two riddles, he said: "The train must go very, very fast, at relativistic speed, very close to the speed of light. When it hits the pea (the round one), it can transfer almost all of its kinetic energy to it. It is a consequence of relativistic kinematics, and if you do not trust me you can go to page 14 of the book 'High Energy Particles,' by Bruno Rossi, 1950, where it says 'a very-high-energy meson or proton can be practically "stopped" by a head-on collision with an electron.' Mesons and protons being much heavier than the electron, the train and the pea are just an extreme extension of that concept."

This was deemed to be the correct response and Mary W had to go on a date with the nerdy guy.

The Recall of Saint Drugaditta

It was the year 1627. Brother Thomasz was a Dominican friar who had spent most of his life studying the writings of Saint Drugaditta. Born in Prague, he had spent time at convents in many European cities, including Rome. He was fluent in many languages and was considered an outstanding theologian. Saint Drugaditta had lived in the 9th century, and had originated from a family of Longobard rulers. Throughout the wars, invasions, and famines of that dark period, Drugaditta had gradually increased her reputation as a theologian and a philosopher. Her writings were also infused with a profound ardor, the sharpness of her intellect always competing with the purity of her faith.

Brother Thomasz, after long hours of study and meditation on her writings, had almost reached a level of personal communion with the Saint. It was not surprising, then, that when some original manuscripts attributed to the Saint were found in the Franzhollern Castle in Leipzig, Brother Thomasz was the one asked to go and investigate the find.

The precious manuscripts had been found in an area of the castle that had been closed for centuries due to the damage produced by previous wars. The current owners of the castle had decided to do some renovation and the workers had stumbled on the manuscripts. The papers were very hard to decipher and only an expert like Brother Thomasz could make sense of the words.

As soon as Brother Thomasz started delving into the monumental stack of documents, he could not believe what he was reading. Instead of the learned disquisition about the Divine Trinity that he was expecting, the most licentious description of orgiastic debauchery laid open in front of his eyes. Unfortunately for poor Brother Thomasz, he did not have the slightest doubt as to the authorship of the writings. After all the hours spent studying and transcribing the words of his beloved Saint, he knew all the details of her handwriting. Just like Malvolio in Shakespeare's Twelfth Night, he could see her C's, her U's, and her T's, perhaps even her great P's.

Brother Thomasz was flabbergasted. Drugaditta displayed an extraordinary inclination for describing in vivid details the amorous life of the court where she had grown up. On one occasion, she gave a graphic account of the visit from three young Vikings, sent by the king of Norway, and how they had entertained the princesses with their horned hats. As a young girl, Drugaditta had been studying with a learned old man who was supposed to teach her the entire spectrum of human knowledge. As he was also a dirty old man, he had instilled in her all the knowledge of every possible perversion.

For days Brother Thomasz sat transfixed looking into the old manuscripts. Something was happening to him. During the day he was delving into the most prurient pornography and felt spasms of desire. At night he felt ashamed of himself and went back to the religious writings of Drugaditta. Brother Thomazs wanted to know everything about his beloved Saint, but now he came to realize that this was impossible. The closer he came to knowing the woman, the less he knew about the Saint. At night, the more knowledge he acquired on the Saint, the less he knew about the woman.

The continuous struggle and the realization that he could not overcome this inherent uncertainty became intolerable for Brother Thomasz (he was keeping a diary). His health deteriorated, and he eventually died.

*****

After the death of Brother Thomasz his diary was found. The Church, as any other responsible large corporation would have done, acted quickly and issued a recall for Saint Drugaditta. All references to her existence were deleted. For some reason she had acquired fame and devotion in a remote part of Spain, and there was some resistance from some of her faithful. But they were dealt with swiftly and properly, and they were burnt at the stake as heretics. That is why today to our knowledge we do not celebrate a Saint Drugaditta.

*****

Exactly 400 years later, in 1927, a young man by the name of Werner Heisenberg became a professor at the University of Leipzig, not far from the remains of the Franzhollern Castle. He had come to the realization (while recovering from an allergy in the island of Heligoland) that the more he knew about position, the less he knew about momentum. This also held true for time and energy. He wrote a paper on the uncertainty principle, and went on to win the Nobel prize.

Thermodynamics of Hot Potatoes

The concept of an absolute zero for temperature seems to have been formulated near the end of the seventeenth century, based on the behavior of perfect gases. However, it took another couple of centuries before people could attain temperatures lower than those found in nature, by liquefying gases and getting closer and closer to the absolute zero. In doing so, three things were realized:

1) New extraordinary properties of matter were discovered that resulted in the use of words commonly associated with superheroes, such as superconductivity and superfluidity.

2) When you work your butt off trying to bring a piece of matter close to the absolute zero, energy will be taken out in the form of heat, but it is the entropy, not the energy, that will tend to zero, meaning that

you go to a more ordered state and a less messy one.

3) Even if you could reach the absolute zero, some weird energy (known as zero-point energy) would remain in the piece of matter, as explained by quantum theory, courtesy of the uncertainty principle, and similar things.

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Ataulfo Reynaldo Tresgracias was a diplomatic attaché at the embassy of Parador in the capital of a European country which had long been characterized by its neutrality, and was accordingly the major seat of international organizations. Parador was a small and hot tropical country, located maybe somewhere between Ecuador and Paraguay, but one that you could not find on current and even future world maps. As you could not find, for that matter, the capital of the European country where this story takes place.

The country of Parador was unfortunately well known for the number of scandals that were periodically cropping up, probably because of its extraordinarily corrupt leadership. Highly placed individuals in government had been associated with illegal arms deals, women trafficking, drug trades, you name it. Each time a scandal would surface, it had a repercussion at the embassy, where it appeared in the form of a hot potato.

Ataulfo's personal life was a mess. He had been through multiple turbulent relationships with women and had lost money gambling on horses. In spite of this, or maybe because of this, he was a smooth operator and he had established relationships with personnel at many of the foreign embassies and consulates in the city. He was well thought of at work, mostly because he had devised a way to deflect the impact of scandals on the embassy.

Every time a hot potato landed on the ambassador's desk, Ataulfo would take it, properly thermally shield it, and somehow drop it off at some other embassy or consulate. The hot potatoes contained a certain amount of mischief, which was given off during the cooling process. Of course, the release of the hot potato's mischief would cause just that – mischief - but it was ok because it would take place under someone else's jurisdiction. Over time, Ataulfo discovered that the cooling was faster when the potatoes were delivered to the diplomatic missions of countries with cold climates.

For example, after a hot potato had reached the embassy of Icemark, the wife of that country's ambassador had run away with a security guard.

When a nasty hot potato was dropped on the lap of the military attaché of Snoway, a high official of that country was found guilty of embezzling defense funds. And on another occasion, an archbishop from Glacia who was visiting that country's consulate where - guess what? Ataulfo had delivered one of his hot items - was found to have a predilection for little kids. Such was the power of the energy - sorry, I mean the mischief - contained in and discharged by those hot potatoes!

One day a particularly nasty hot potato arrived at the embassy of Parador. This was a huge Idaho potato and its temperature was so high it could have melted tungsten. Ataulfo had a connection to the embassy of Frostland, which was the country with the lowest recorded temperature in the world. But when he arrived there, he found that his contact had been called back home and had been replaced by a woman by the name of Ulrika Sherbetsson. Ulrika was a woman of almost impossible beauty, fitting the description of a princess in the most preposterous fairy tale. She was cool while also hot, and Ataulfo was dutifully impressed by her (this is probably an understatement).

As expected, a large amount of mischief came out of the potato and caused havoc. But we are not concerned with that since the story took a different turn.

The drop in temperature was so incredibly high that the potato got very close to absolute zero, and three things happened, which had some similarities to the physics phenomena listed at the beginning of this story, although not necessarily in the same order:

1) Quantum effects took place, meaning that some amount of mischief, sort of a zero-point mischief, was left in. However, this was a small mischief, the kind that you find in the facial expression of models on the covers of fashion magazines and which is actually quite attractive. Or in the intimidating stride of the supermodels walking down the runway in a fashion show. In short, the allure of the femme fatale.

2) Strange phenomena, which had not revealed themselves up to that time, took place in the heart of Ataulfo, who eventually came to recognize that he had fallen in love with Ulrika.

3) We cannot be sure that entropy equivalent considerations, associated with the extreme cooling of the potato, had something to do with this. But Ataulfo gave up his messy life and transitioned to a more

ordered way of living, which resulted in his love being reciprocated.

Ataulfo Tresgracias and Ulrika Sherbetsson eventually married. They left the diplomatic work and moved to a different country, Blissland, which had a temperate climate. There, they lived happily ever after.

SESTA GIORNATA (SIXTH DAY)
STORIES CONNECTED WITH MEMORY

The stories narrated during this day are somewhat related to memory. Whose memory, you may ask. Sometimes it's the memory of the author, sometimes it's the memory of the characters in the book, and sometimes it's the collective memory of humanity. And if you think that this is weird you are probably right! As everyone knows, memory can be selective. Hopefully the stories abide to a rigorous selectivity criterium, without which no moral purpose could even be claimed. And of course, just like the other stories, they contribute to the unity of the book by having a connection, direct or indirect, to some aspects of the world of physics.

The difficulty of being a good Samaritan. Cohesive forces in matter and in life. Interpretations of the electromagnetic field. How not to communicate with your doctor. These stories and others are narrated during this day.

Of Distinguishing Things

Flight RG-8865 had left New York with a delay of two hours and would probably arrive at its destination, São Paulo, Brazil, two hours late. Sitting next to each other in economy class, Professor Gianluca Baragatti and his wife Berenice had just finished dinner. Compared to domestic American carriers, the Brazilian airline still offered decent meals, including free after dinner drinks. Sipping his brandy, Gianluca started talking to the fellow sitting next to him, who was also an elderly gentleman, an American by the name of Bob Antal. After a while, Gianluca discovered to his surprise that his neighbor shared an interest in quantum mechanics, due to both professional and personal experience, and the two started talking about related subjects.

Bob was going to Brazil for the first time, while Gianluca considered himself an expert on Brazil, since earlier in his life he had spent some time working at a university there, and his wife was, in fact, a Brazilian native. All of them were going to Rio de Janeiro, where Bob was going to stay at a hotel in the Ipanema district. Gianluca, being an expert on Brazil, had rented an apartment through the Internet, also in Ipanema.

“Someone will pick us up at the airport and take us to Ipanema,” said Gianluca to Bob. “If you are interested, you can join us and I can ask the driver to drop you off at your hotel.” They left it at that and talked about quantum mechanics. “To me,” said Gianluca, “the most peculiar thing in quantum mechanics is that identical particles are totally, and I mean totally, indistinguishable from each other. Classically, you can tag, therefore distinguish two identical twins. Not so with two electrons, with profound consequences for, as you know, quantum statistics and those sorts of things.”

“I do not know about those sorts of things,” interjected Berenice, “but I know that, when it comes to distinguishing things, you do not distinguish any of them. As a matter of fact, sometimes I wonder whether you can really distinguish a hole in the ground from…”

“Your husband is a real quantum mechanical man, ma’am,” said Bob diplomatically.

They went on talking about different things. “You have to be careful about the Brazilian police,” said Gianluca to Bob. “There is a lot of corruption in the military police, they are inefficient and can be very rough, so do not mess with them.” Then he added, “We will be late in São Paulo, therefore we will miss the connection to Rio. Hopefully our driver will wait.”

*****

At Tom Jobim international airport in Rio de Janeiro, Raimundo was pissed. He had been told to pick up a couple of gringos and take them to Ipanema, but now it appeared that they would be arriving on a later flight from São Paulo. The apartment rental agency did not pay him much for his service, maybe the gringos would give him a tip for waiting longer. As he was standing next to the exit gate holding his silly sign with the word “BARAGATTI” in large capital letters, a dark stranger struck up a conversation.

“Amigo, it looks like you will be here for a while,” said the stranger. “I have the same problem, waiting for people who are delayed. What do you say that we have a drink while we wait? There is a good place not far from the domestic arrival terminal. You keep me company and the drinks will be on me.”

Raimundo hesitated, but then, what was there to lose. He followed the stranger to the bar, they sat down, and ordered caipirinhas, the strong

Brazilian cocktail made out of lime, sugar, and sugarcane brandy. They both commiserated about being forced to waste time in a dull airport, while they could have been spending their time more productively watching young babes on the beach at Copacabana. At some point Raimundo went to the bathroom, and the stranger poured some white powder in Raimundo's drink.

After Raimundo returned and finished his drink, it did not take long for him to feel drowsy. After a while he was sound asleep, with his head reclined into his arms and resting on the table. The stranger left him in this position while walking away with the silly sign that said "BARAGATTI" in large capital letters.

*****

The plane from São Paulo arrived and the passengers were slowly coming out of the gate. A mixed crowd of relatives, service providers, and plain onlookers waited nearby. Gianluca Baragatti was scanning the crowd, without success, and it was Berenice who first spotted the man holding the sign. "I do not like his looks," she said, "I would not trust him." "You are so paranoid," said Gianluca.

So off they went, dragging Bob who had accepted the offer of transportation. Besides, the driver had appeared to be very happy to take another passenger along.

They left the airport and got onto the highway that leads to the center of the city, then to Botafogo Bay, and eventually to the Southern beaches on the Atlantic. At some point the driver said that he knew a shortcut that would have avoided a lot of traffic, and was also quite picturesque, and got off the highway.

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They had been driving for a while, and the landscape around had changed. It was a mixture of industrial and rundown residential districts, obviously a very poor part of town, and getting worse. The occupants of the car were silent and started to get worried.

At some point, the traffic slowed down and the driver was forced to stop. Brazilian military police with blue helmets were advancing on both sides of the line of cars. An officer passed by, then stopped suddenly and turned back to face the driver.

“Luizinho!” He shouted while quickly motioning to two MPs to come over. “What are you doing here?! Last time I saw you, you were in a prison in Manaus!”

Luizinho tried to explain to an unbelieving Lieutenant Pereira that he was working for a rental agency and that he was transporting passengers to the city. The Lieutenant got the rental agency number from Gianluca and a quick call destroyed that story. After that he got in touch with security at the airport where Raimundo had been found and handled as a regular drunk. Then he arranged for real transportation for the somewhat shaken passengers.

*****

In the evening, Gianluca, Bob, and Berenice got together for a nice dinner in Ipanema. They talked about the events of the day over some caipirinhas.

“The random events today were unbelievable,” said Gianluca. “We were lucky that today the police were making a sweep of the accesses to the favelas. And even luckier that the smart, efficient, and even polite military police officer knew that dangerous character. This coming together of random events reminds me very much of quantum mechanics.”

“In this particular case,” said Bob, “I am glad that Rio seems to be more classical than quantum, since someone is still able to distinguish things.”

Berenice had the last word. Sipping her caipirinha, she said, “Quantum or classical, I still think that my dear husband cannot distinguish his ass from a hole in the ground.”

Cohesive Forces

It is a Saturday night in January, at the beginning of the 1970s, and it is extremely hot. We are, you see, in Rio de Janeiro. It is right on the Tropic, and the sun has done its work today. We are sitting at an open-air bar on Avenida Atlantica, not far from the Arpoador spot that separates the two stretches of Copacabana and Ipanema. We can see the lights on top of the Sugar Loaf Mountain, and at times the wind brings us the rhythmic sound of the samba schools preparing for Carnaval.

Today Copacabana Beach was glorious. There is a special flavor that only a right-wing dictatorship can impart to a Mediterranean or Atlantic beach.

We are all of leftist tendencies and we hate the dictatorship, but we all admit this as a fact. We recognized that special flavor on the beaches of Spain, when Franco was in power, and we would have recognized it on the beaches of Italy, when Mussolini was in power. We thought it had something to do with the wind carrying the smell of Africa, I mean the smell of Africa during colonial times, when a young man could dream of adventures there.

Once in a while a girl from Ipanema (tall and tanned and everything else) walks by, followed by our sighs. The girl from Ipanema is a mental category, a symbol, an abstraction, an impossible dream.

In any case we are four males, relatively young, more or less attached, and all somehow associated with the Institute of Physics at the University of Rio. Two of us, Edson and Laercio, are Brazilians. François (the Belgian) and I are what you would call "visiting scientists" getting our tropical education at the expense of some international organization.

We come here occasionally to drink beer and talk nonsense, which means finding connections between aspects of human life and concepts in physics, especially modern physics. Apparently, this was a tradition that was started by a visiting British scientist, so the Brazilians are trying to keep this tradition alive, which explains why they have involved François and me in this.

"As was mentioned before to give all of us some time to think about it, the topic for tonight is bonds between man and woman versus cohesion in solids. Can we claim a correlation?" asks Laercio.

"We certainly can," starts François. "As you all know, I mean as you all know now because you looked it up, there are four main types of solids, namely valence, metallic, ionic, and molecular. To each type corresponds a type of bond or cohesive force. So, we should try to find correlations to these concepts, and maybe use our personal experience."

"OK, then," says Edson. "First of all, what keeps a solid together are the electrons. The electrons are like glue. I have observed that in many cases what keeps a man and a woman together are children, so I would compare the electrons to children. And of course, every solid stays together up to a point - if you raise the temperature enough it melts, evaporates, sublimates. Same with a union, I do not care how perfect you make it, if you raise the 'temperature' enough, it will crack apart. When I think of myself, I think I fit the pattern of a valence lattice. The distributions of charge of two

electrons in a covalent bond are pretty much on top of each other. It is the same with me and my wife, we tend to keep to ourselves, we share the children, but also thoughts and feelings."

"In that case," says François, "I fit the metallic pattern. In this pattern some of the electrons behave like a gas and are distributed over the entire crystal. Back in Belgium we have a very extended family and lots of friends. We are constantly exchanging children and at times we do not know with which uncle or aunt the children are with. It is a very clannish and metallic thing. All this running keeps us together, no matter how many girls from Ipanema walk by, no matter how tall or how tanned they are."

Two girls from Ipanema go by, altering the course of our thoughts. "You should get one of those," Edson teases me. "I seriously doubt it. They are tall. They are tanned. They are out of reach," I hear myself saying. Edson laughs, "They have high heels. And they are not tanned, they were born that way. And they are not out of your reach. Besides, the original words of the song in Portuguese say nothing about being tall or tanned. On the contrary, they seem to imply that beauty is lonely too. Did you know that Vinicius de Moraes, who wrote the words of the song, was a poet and a Brazilian diplomat? Someday the world, I mean the first world, will realize that we have first class diplomats."

"Going back to the main theme, my girlfriend and I are ionic types," says Laercio. "I am always ready to grab something, and she is always ready to give something. When we are in these states, there is a strong attractive force that keeps us together. Good old electrostatics, you know. Although we have to be careful and not stay too long in the water..."

"Well, it is my turn," I say, "and, just for the sake of symmetry, I shall try to correlate myself to the last category, the molecular type crystals, which stay together because of van der Waals forces. As you know, these solids are made of neutral molecules or atoms such as noble gases, which do not mix well (I do not make friends easily). We are talking solid argon, solid neon, and you have to go to really low temperatures to keep these things together. So, it does not take long for such a union to break apart. Anyway, when everything is quiet, and certain conditions apply, it is like playing classical music - we can get polarized, meaning that we get stretched in such a way that a dipole moment develops, resulting in attraction."

This last metaphor is well received and meets with the approval of the audience. We find it remarkable that every one of us has been able to relate

himself to one of the four types of explanation for cohesion in solids. This calls for another round of cold beers.

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As the evening progresses the noise subsides and the temperature starts to drop. There is a sense of magic in the air. A light breeze comes in from Guanabara Bay, carrying exotic aromas and tropical sounds. A girl from Ipanema goes by, and I suddenly feel stretching and polarization. She may be wearing high heels, and the expensive-looking tan may be natural. And who knows - maybe I can get her interested in quantum mechanics. I get up and follow the girl into the night.

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Years later, I figure that something must have been wrong with the model, because the van der Waals forces have turned out to be far stronger than anyone would have guessed.

Matryoshkas

It was the year 1972. Professor Gianluca Baragatti was walking along Avenida Copacabana in Rio de Janeiro. It was about six o'clock in the afternoon and he had just disembarked from the bus that was taking personnel from the Institute of Nuclear Engineering back to the city, after a day of work. Gianluca was walking back to his apartment which was located about a quarter of a mile from where the bus had stopped. He had turned into Avenida Copacabana, which runs parallel to the most famous Avenida Atlantica, and is very different from it. While Avenida Atlantica runs along the ocean, offering views of fancy hotels, restaurants, and advanced beach attire, Avenida Copacabana is mainly a commercial street with a wide variety of shops and a multiethnic flavor.

After walking a few minutes, Professor Baragatti stopped in front of an antique dealer shop. In the windows one could see several artifacts of different origin. The exposed articles were mostly from the colonial period, ranging from fancy furniture items to humble tools. By observing these objects, one could have recreated a mental image of the life of the masters and the slaves, in a previous era. However, Gianluca's attention was taken by a set of small dolls whose origin was clearly from Russia. The dolls

were the kind which are carved from wood in such a way that they can be stacked into each other, from the smallest to the largest, and they are brightly painted. They usually represent female figures, hence the name Matryoshkas, but they are also known as Russian dolls.

After the dolls became popular, the term Matryoshka has been used as a metaphor for things containing (similar) smaller things. In nanotechnology, for example, a Russian doll model for carbon nanotubes has been introduced. And in principle, the name could also be applied to certain written stories, like a story within the story, if you know what I mean.

After viewing the dolls, due to some strange mental connection, Gianluca was reminded of a book that was published in 1986. The book, "Inward Bound," by the distinguished physicist Abraham Pais, is a fascinating description of the development of physics, mostly in the past century, with an eye to the discovery of smaller and smaller things. First the atom, postulated even by the Greeks, then the electron, the nucleus, the last one containing protons and neutrons, and finally (maybe?), these last particles consisting of quarks. This exploration of things containing smaller and smaller things may bear a faint relationship to a Matryoshka concept.

Gianluca Baragatti walked away from the antique shop with the words "Inward Bound" stuck in his head.

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Many years later, Professor Baragatti, in his spare time (of which he had plenty, according to his wife Berenice), had started writing some silly stories that had some implausible references to physics and quantum theory. These were supposedly humorous stories, with an irreverent slant toward religious fads. He collected the stories and printed them as a book under the name Quantum Yoga. The book was illustrated with some figures that could be considered mildly offensive. In some of the stories there were two totally, and I mean totally, fictional characters, Prof. Gianluigi

Barabaschi and his wife Euridice. Some of Professor Baragatti's friends who read the stories mistakenly thought that there was a similarity between the character Gianluigi and Gianluca, and also between the character Euridice and Gianluca's wife Berenice.

In any case Gianluca had fifty copies of the little book printed and gave them away to friends and acquaintances. The reactions varied. Some of the friends were enthusiastic, while others did not say anything; maybe they did not even read the book. One lady in particular, by the name of Geena, was enthusiastically supportive of the book and was always urging Gianluca to write more stories. In addition, none of the readers, probably because of humane sensitivity and cultured upbringing, came straight out and said: "Your book is a piece of human waste."

Because of those reactions, Gianluca explored the possibility of publishing the book. He made a search on the internet for the word self-publishing, and very quickly found several sites that put prospective authors in touch with publishers. All you needed to do was fill in a form with some personal information and upload it. Gianluca did this.

Five minutes after he hit the key to submit the form his phone rang. It was an unknown number, so Gianluca did not pick up the phone and let the call be recorded. A sexy female voice said: "Hi Gianluca. This is Helen, from Trojan Book Publishing. We can help you to publish and promote your book…blah … blah… blah…"

"Good," thought Gianluca, "Helen of Troy got in touch with me. Their company seems to have done a good job promoting Homer's works. I shall keep them in mind."

One hour later the phone rang again and a message was left. "Hi Gianluca," said a melodious female voice. "This is Cleopatra, with Pyramid Book Publishing. We can help you to publish and promote your book…blah … blah… blah…"

"Good," thought Gianluca, "Cleopatra Queen of Egypt got in touch with me. Their company seems to have done a good job promoting Shakespeare's works. I shall keep them in mind too."

In the following hours a few similar messages were left on the answering machine. The messages were always from women with names that could be related to history, mythology, or even operas. "Carmen from Zingari Book Publishing just left me a message," said Gianluca. "Be careful with that

one," said Berenice. "She may be dangerous."

The next day the ladies, or the companies they were working for, sent e-mails containing proposals for editing, publishing, promoting the book, and much more, as long as the author paid for the services. Professor Baragatti looked at the proposals, which were quite expensive, and was perplexed for a while. But ultimately he agreed with Berenice, who had been suspicious of the "vanity" publishers from the start, and he respectfully declined all the offers and propositions. Instead, he decided to make an electronic version of his silly book and make it available to a wider (maybe) audience, through Amazon.

For a while Gianluca thought about writing a story in which his fictional character Gianluigi would be writing a book with silly, humorous stories having some connection with physics, and so on. But then he gave up on the idea, although the words "matryoshkas" and "Inward Bound" kept coming back to his mind.

The Reawaken Café

The Reawaken Café (literally *Caffè del Risveglio*) was located at the corner of Viale Romagna with Via Botticelli, one of the streets leading to the State University of Milan. It was nothing similar to anything you could find today in the café category. Although its customers could have been able in principle to order an espresso or a cappuccino, the café was mostly a tavern, with a few connected rooms with simple tables and chairs, and the usual fare was wine. Depending on the time of the day, and on the day of the week, the population of the café varied, but two groups predominated.

One group was made up of blue-collar workers, who were smoking heavily and playing cards. The workers tended to be loud and must have been very religious, judging from the frequency with which the names of the Father, the Son, the Madonna, and an innumerable number of saints were invoked.

The second group consisted of students from the local University. The café was quite close to the buildings where classes were held, and the calendar of the classes was fairly erratic. There were gaps between classes, and often lectures were cancelled either because the Professor was busy making money somewhere else or because of strikes. Thus, it was not surprising that groups of students were using the Reawaken Café as a waiting room, either in the morning or in the afternoon. Besides, wine was cheap in those

days.

Some of us, beginning physics students, had soon discovered the Reawaken Café. You should not think that we were just wasting time and getting drunk. Instead, a selected (or so we thought) group of us had started a kind of informal Academy, in which scientific and occasionally philosophical subjects were discussed and debated.

On this day of a November many decades ago, one of us, I forget who, brought up the following. In a book by Enrico Persico (Introduction to Mathematical Physics) one finds the following quote (roughly translated into English): "Experience shows that the magnetic field generated by the current in a coil is independent of the permeability of the medium in which the coil is immersed. Instead, the field generated by a permanent magnet is inversely proportional to the permeability of the medium." The permeability is just a characteristic parameter describing how a medium is influenced by a magnetic field.

Now, if you continue reading Persico's book, or any other book on electromagnetism for that matter, you will eventually figure out why the statement above is true. But if you are not very familiar with these concepts, or if, in your old age, you have almost completely forgotten what you had learnt as a student, the statement may appear a bit puzzling. This was the question we were struggling with that day at the Reawaken Café, trying to find a simple answer.

"Yes, why is that?" said Franco P. "At first sight, one would think that the magnet and the coil are equivalent. Looking from a distance, they both generate a dipole type field, similar in appearance. One can adjust the current in the coil so that the fields have the same intensities. Why then, if we immerse both the magnet and the coil in a medium, let us say water, do we obtain different results?"

"No water, no water, let us immerse them in wine!" was the general reaction of our group, reinforced by a sequence of invocations to the Madonna coming from the next room.

"*Olio di ricino* (Castor-oil)," mumbled Giovanni M. to himself, who was known to have fascist tendencies.

"It would be good to have a simple explanation for this effect, something that could be useful for the education of the exploited proletarian masses," said Lorenzo E., who was known to have Marxist tendencies. The exploited

proletarian masses in the next room responded with a salvo of invocations to Jesus.

The first to come up with a serious explanation was Armando F-P., who, partially due to his hyphenated last name, was known as an expert in amorous affairs, and was always able to find sexual connotations in most aspects of everyday life.

“It all seems very clear and simple to me,” said Armando. “I do not know in other languages, but in Italian, the coil (***la*** *bobina*) is feminine, while the magnet (***il*** *magnete*) is clearly masculine. Besides, the coil is hollow, while the magnet can be in the form of an excited cylinder. Given the proper geometry and the proper orientation, the forces of the field are such that the second one can be naturally attracted into the first one. Therefore, I do not find it strange that the coil and the magnet have a different behavior.”

“As usual, Armando, you are full of shit,” said Ileana F., who, besides being the only woman in our little group, was also the only woman to ever have entered the Reawaken Café. Ileana was not a classical beauty, but she had an uncontainable vitality and inner magnetism that made heads turn, and she used strong words that girls were not even supposed to know in those days. “I can destroy your silly theory very quickly. From a linguistic standpoint, even in Italian, the coil (***il*** *solenoide*) can be masculine, while the magnet (***la*** *calamita*) can be feminine. And for the rest, all you need to do is change the direction of the current in the coil to make your magnet fly away and jump into the lake…” These words were punctuated by numerous invocations to Saint Anthony, coming from the next room.

Up to this point, Carlo C. had been quiet, with a look of amusement on his face. Carlo was unanimously recognized as the only one in our group who would eventually amount to somebody in the field of physics and/or mathematics. Later on, he did significant work in the field of transport theory, wrote several books on the subject, and has recently published a biography of Boltzmann. Therefore, it should not be surprising that we were looking at him for a real explanation.

“All of electromagnetism is due to electrical charges,” said Carlo C. “Fixed charges create electrical fields, and moving charges, or currents, create magnetic fields. The magnetic field created by a permanent magnet is due to tiny little currents, mostly caused by electron rotation or spin that, because of the past history of the magnet, have been convinced to cooperate and to point in the same direction, something that our politicians

would never do. Suppose that I take a coil, in which I run a current of, say one amp. Then I immerse the coil in wine. Even though there is some magnetization in the wine, this is not going to affect the coil, into which I continue to run one amp. Now let us take a magnet which is equivalent to the coil, and also immerse it in wine. The tiny induced magnetization in the wine will affect the tiny currents in the magnet, leading to a change of the field. So, it seems to me that Persico's statement means that the magnet can be influenced by its environment, while the coil, as long as the current is kept the same, is not influenced by the environment."

"And this fits very well with my previous theory based on sex," said Armando F-P., "because man is sensitive to the environment, and woman is not. In support of this, have you ever seen a well-dressed, beautiful lady arriving late for a major opening night at a theater? She will advance with a smile on her face, totally unperturbed, bothering half a row of spectators. She is followed by her poor husband, who tries to make himself as inconspicuous as possible, bending left and right while proffering a thousand apologies, obviously being very sensitive and susceptible to the environment…"

"No, we have never seen such a thing, and neither have you," said Ileana F. "And it is obvious that you are even more full of shit."

Those words having been received with a lot of approval, we finished our wine and went back to the school for another class, just as the Reawaken Café seemed to be exploding with another episode of religious fervor.

Physics for Philosophers

There are a lot of us here, at Entropic University, studying physics and engineering. After the war ended a lot of work went into reconstruction, and there was a need for professionals in conventional areas such as civil engineering. But the war had also given a strong impulse to research, and physics seemed to offer unbounded opportunities. The field chosen is not easy, and all of us newcomers to the field are studying hard to learn the basics. Of course there are differences between us, some are smarter than others, some may even turn into small geniuses and discover things, but all of us at least try to apply ourselves diligently to the job of learning. And then there is Riccardo.

Riccardo comes with a background in classical studies, obtained not

through formal education, but mostly from self-study. He is often quoting Homer, and tries to find explanations, not from physical laws, but through associations of ideas. We consider him an expert on Greek mythology. These days we are currently studying electricity and magnetism, the classical aspect of it, not the quantum one which will come later, and Riccardo has convinced himself that he has mastered the field.

The other day I asked him, "If you have a current going through a wire, do you know how to calculate the magnetic field around it?" "Huh?" said he. "Riccardo," I explained, "for these things you need equations, formulas, if you wish." "Yes, I know, but there is a better way to fully understand these things."

And so he proceeded to describe to me his understanding of the electric and magnetic fields. "The electric field," he said, "is in many ways like Aristotle, while the magnetic field is more like Plato." He noticed the puzzled look on my face and began to explain: "There are three aspects to this."

"First, Aristotle was a realist, a practical man. In contrast, Plato was an idealist, looking for forms and ideas beyond those immediately available to the senses. You will admit that electricity is somewhat more real in our daily lives than magnetism," Riccardo continued. "We call an electrician, pay electric bills, know electrical engineers. We do not call a magnetician, do not pay magnetic bills, do not know magnetic engineers." "I have magnets on the refrigerator," I objected, "and they seem real enough." "I do too," he noted, "but that is a minor point."

"Second," he continued, "and this is the main strength of my argument, there is a big difference in how the two fields affect their environment. I quote words from a standard physics book: in the electrical case... blah blah... we have a positive susceptibility, in the magnetic case... blah blah... the induced moment produces a negative susceptibility. So, there is a difference, but what does it mean? To me, it means that while the electric field leads to polarization, the magnetic field leads to inspiration. In other words, if you put a medium in an electric field then the field gets weaker, if you put it in a magnetic field then the field grows stronger."

And in fact Plato knew this, well, some of this at least. In the dialogue called Ion he talks of the effect of a

stone which Euripides calls a magnet, but which is commonly known as the stone of Heraclea. This stone not only attracts rings, but also imparts to

them a similar power of attracting other rings.

Plato calls this property inspiration.

"Well," I said, "it seems to me that our candidates for president are more like the electric field, and they induce polarization more than inspiration." Riccardo did not pay attention to my comment and continued:

"Third, sexual preference. Aristotle had a wife while Plato did not, and we know about his sexual orientation. In the electric case, positive charges attract negative charges, similar to heterosexual people, while in the magnetic case existing dipoles take the same orientation as the field. And then we have ferromagnetism, which is an enormous effect and can be compared to Platonic Love, which was considered far superior to whatever could be provided by the senses. All this reinforces my view that the electric field produces polarization, while the magnetic field produces inspiration."

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"All this is very interesting," I replied. "But in any case, Riccardo, do you feel that you are prepared enough to take the exam?" "Absolutely," said Riccardo. "I am confident that the professor and his assistants will appreciate the depth of my thinking."

Apparently neither the professor nor his assistants appreciated the depth of Riccardo's thinking, because he did not pass the exam. We were not surprised.

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Six months later I ran into Riccardo, who by that time had left the physics department. I asked him how he was doing.

"Very well," he answered. "I am working on Socrates now…"

The Things that Last

Some things last longer than others. This essential inequality is true for people and even more for particles. Take the proton, with a half-life of 10^{32} years (maybe more). And also the free neutron, with a half-life of about 15 minutes.

It looked like it was going to be a long night. We were supposed to conduct an experiment at the linear accelerator, for which we had reserved three eight-hour shifts. Since there was competition to use the machine, and changes had to be made in between different experiments, it was not unusual to work for twenty-four hours or more to get data that would maybe end up in a paper and perhaps gain us a trip to some scientific conference, today totally forgotten.

The accelerator was a big machine housed in a well-shielded building. It was taking quiet, peaceful electrons, and repetitively kicking them until they reached tremendous speeds, until the poor things hit a heavy target and released a bunch of neutrons, not terribly happy either. Some of those neutrons travelled down a long tube that passed over a canyon and ended in a little building, where they were welcomed by sets of detectors set up in advance. The commotion of the particle encounters, which were sometimes friendly and other times not (greetings, insults, background gossip), was transmitted to the main building via long cables and recorded with various electronic gadgets. And here was the problem that night.

Electronic gadgets, as you may have observed, occasionally do not work, and they require the intervention of specially trained personnel. I forgot what the specific problem was. As a matter of fact, I have even forgotten what it is that we were trying to accomplish. But in any case, it was clear that a piece of equipment was not performing properly and that we needed the help of an electronic technician.

The guy who was most familiar with the specific equipment was Richard. He was a middle-aged man with a lot of experience in practical electronics and an almost magical ability to diagnose and fix sources of failures. In addition, he was known to be a very serious family man who regularly attended church services, and he was always very helpful. He would occasionally drop some quotations from the Bible, while we would occasionally exchange dirty jokes which, as we liked to say, would have shocked old Richard.

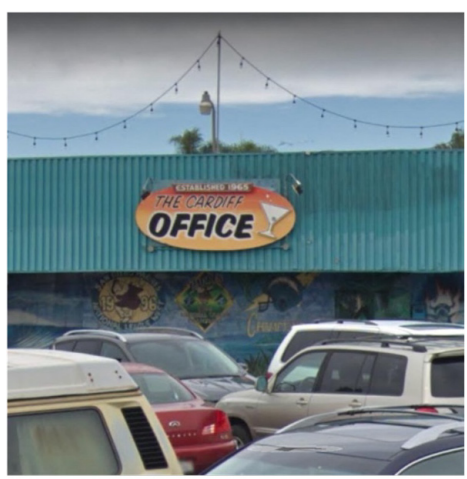
So, that night we faced a gadget failure at almost 11p.m. We decided to call Richard at home, to get his advice. His wife answered and almost immediately informed us that Richard was not at home; he was at the office. After a moment of silence, we thanked her politely, hung up, and looked at each other. Wait a moment, WE are at the office (so to speak) and he is not here! Evidently Richard must have told his wife that he had to work at the office, while he was out for some unconfessable reason. Maybe

he was having an affair.

The electronic gadget must have been as shocked as we were, because it started functioning almost immediately. We began working again and collected our data. This required making some trips out to the detectors, through a path in the canyon, watching for potential rattle snakes and tarantulas (we never saw one but they existed).

For the next few days we looked at Richard with a sort of suspicion mixed with awe, and we half-seriously contemplated various theories about his hidden nocturnal activities. Maybe he was sneaking out of the house and going south of the border. In those days you did not even need a passport to cross the border to and from the large frontier town, where the main street, Avenida Revolucion, was populated with dubious clubs with all sort of attractions. Maybe he was a double agent for an adversary power. Maybe he was Jack the Ripper.

Then one day we learned the truth. A little up north, there was a recently inaugurated bar called The Office. The name was clever, so husbands could just drop the capital letters and tell their wives they were at the office, while enjoying their drinks. And they would not even lie! And Richard was not at the office, he was at The Office, where he was working a second job as a bartender, with the full knowledge of his wife! So much for our theories!

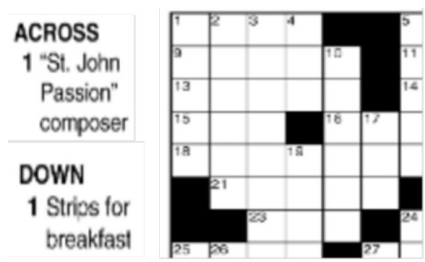


Richard got back his reputation, with some regret on our part, and life was boring again. What is remarkable is that, after more than fifty years, the accelerator is not there anymore and the results from our data can hardly be found. Even the clubs on Avenida Revolucion are not there anymore (they

have moved to another part of town). But The Office is still there, and judging from the number of cars in the parking lot, doing a good business. Definitely some things last longer than others.

Mens Sana in Corpore Sano

Professor Gianluca Baragatti was relaxing by trying to solve some of the puzzles in his daily newspaper. At the moment he was working on a crossword. At the top left corner, starting at 1 across, he needed a four-letter word matching the clue of *"St. John Passion" composer*. "It could be Bach," thought Gianluca, but he was not sure. However, 1 down called for a five-letter word with the clue *strips for breakfast*. This time Professor Baragatti did not hesitate, the answer was clearly "bacon," and the first letter immediately confirmed his suspicion that the missing composer was in fact Bach. "They could have made it more difficult," he thought, "by making the clue *Medieval philosopher* or something similar, to refer to Roger Bacon."



"This simple fact, I mean the connection from bacon to Bach, illustrates that something related to lower categories, such as eating, or other bodily functions, can actually have an influence on our knowledge of cultural issues," thought Gianluca. This made sense to him, because eating was one of the necessities for having a sound body. It is also a good prerequisite, if not a necessity, for having a sound mind, or, as the Romans used to say, *mens sana in corpore sano*. That said, according to Gianluca's wife Berenice, bacon for breakfast was not to be considered a healthy diet, especially at an advanced age.

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For about a year a pandemic had been sweeping the world. A virus of unknown origin had propagated and caused a large number of deaths in

multiple countries. Eventually vaccines had been developed and it looked like there was hope for a return to normal life. Because the vaccine was manufactured and introduced gradually, its distribution was prioritized. Medical personnel, and also older people (who were deemed to be at higher risk) were among the first eligible to be vaccinated. Accordingly, Professor Baragatti and his wife Berenice dutifully received the vaccine. Their daughter Vanessa, who was now working remotely and living at their house because of the pandemic, was too young to be prioritized for the vaccine and thus was concerned she could become a potential risk to the health of her parents.

When the CBC (Center for Bliss Control) issued a new directive, Vanessa thought that she and her family might benefit from it. According to the directive, people who were providing assistance to elderly family members (also called informal caregivers) could be considered essential workers who would therefore be eligible for the vaccine. This status needed to be proven by a statement from the elderly person's physician. "Dad," sad Vanessa, "I accompanied you to your last medical appointment. You could ask Dr. Corleone to write a note stating that I am an informal caregiver."

This made sense, but Professor Baragatti had a weird sense of humor, so he spent several hours drafting the following letter to his physician:

> Dear Dr. Corleone,
>
> Thank you for having taken care of my health for many years, most of the time against my best judgment. As you know, based on my last visit with you, during which I was accompanied by my daughter Vanessa, I am no more the person that I used to be, and regrettably I need assistance in most of my daily functions. Specifically, mostly but not always, I need help in order to:
>
> - Not drive too fast
> - Avoid excessive drinking
> - Limit the quantity of hot spices in my food
> - Control my language with regard to gender issues
>
> To deal with the above and other problems which creep up every day I have come to rely on the assistance provided by my daughter Vanessa. She also turns off the lights and takes

> away my books on physics, astronomy, astrology, alchemy, etc. so that I can get some sleep and maintain a sound mind. In conclusion I can say that without my daughter I could not maintain a *mens sana in corpore sano*. Accordingly, I would very much appreciate it if you could write a letter stating that Vanessa is in fact an informal caregiver and is eligible for vaccination.
>
> Sincerely
>
> Gianluca Baragatti

When Vanessa and Berenice looked at the draft, they were incensed. "You cannot write things like that." So, Vanessa, whose full-time job seemed to involve writing thousands of e-mails a day, took five minutes and re-drafted a terse and business-like note from Gianluca to Dr. Corleone.

After Dr. Corleone received the note, he drafted the following response:

> To Whom It May Concern,
>
> Gianluca Baragatti is and has been under my professional care, most of the time against what he calls his best judgment. This is a misnomer, since he has no judgment. He has chronic medical conditions that make him immunocompromised and at high risk of complications and even death if exposed to the virus. In fact, it is strange that he is still alive. Because of overindulgence with eating, drinking, and God knows what other form of dissipation, his physical condition is a mess. And his mind is no better. When I last checked his memory, by asking him who had discovered relativity, he answered Newton. In short, as the Romans would have said, *mens debilis in corpore debole*. He is lucky to have his daughter, Vanessa Baragatti, as a caregiver. As such, she accompanies him to his medical appointments, coordinates his medical care, and provides assistance within the home for the patient. She also attempts to prevent him from doing stupid things, which seems like an impossible task. Good luck to her. In any case, under the directive of the CBC (Center for Bliss Control), this young lady qualifies as an informal caregiver and is therefore eligible for vaccination.
>
> Sincerely,

Pierluigi Corleone, MD

When Ashley McPayne, administrative assistant to Dr. Corleone, looked at the draft, she refused to forward it. “You cannot write a letter like this to a patient.” So, in about five minutes she rewrote a terse and business-like letter which was signed by the doctor and forwarded to Gianluca.

As of this writing, Vanessa is still trying to get an appointment for vaccination. Meanwhile, she is busy working, walking, bicycling, and surfing - all things that her father cannot do (and would not do even if he could), but that contribute to keep her *mens sana in corpore sano*.

The Ballet Dancer

Professor Gianluca Baragatti went to Seattle for a few days to visit his daughter Vanessa, who had wanted to spend some quality time with her father. The two of them managed to have quality time indeed. They went to some restaurants, they took a ferry to a nearby island, they bought oysters at a vibrant fish market, and took a leisurely walk in a park thick with trees. To properly balance all this with some sort of cultural activity, one night they went to the theater to see a ballet performance.

The program consisted of two parts. The first part was a very modern composition, at least as far as Gianluca could tell. The dancers were executing very rhythmic movements, that reminded him of harmonic oscillators. For a while they were stretching one leg in a periodic fashion, following the bursts of the music. When they stopped, it looked like there was still some vibrational energy in them. “Definitely quantum harmonic oscillators,” thought Gianluca.

The second part of the program was an interpretation of Carmina Burana, choral music based on a mixture of irreverent songs and poems from the Middle Ages. The dancers were sometimes dressed as monks burdened with unlimited penance, and at other times were wearing tight body wrappers that made them appear totally naked. The interaction of men and women when wearing this last costume was very realistic (with tongue in cheek, Vanessa would later refer to this part of the ballet as *soft porn*). This portion made Gianluca forget about quantum mechanics. Instead, he thought of a passage in Proust’s *A La Recherche Du Temps Perdu*, where the writer implies that the sexual positions of man and woman are an attempt to reunite what Creation has divided. The old Adam’s rib, if you

wish. “Boccaccio would have really loved this show, the mix of sacred and profane is just like in the Decameron,” thought Gianluca.

When the performance ended, Vanessa wanted to use one of those services where common folks impersonate taxi drivers and take you around in their personal car. But Gianluca, who loved public transportation, insisted that they should take the bus back, even though that meant waiting a bit in the street, amidst a temperature on the cold side. To pass time, they walked around the block, which provided an opportunity to notice the local fauna exiting from a nearby nightclub.

Back at the bus stop, they noticed a tall, slender young woman, elegantly dressed in black, accompanied by a young man. The two also got on the bus and sat right in front of Gianluca and Vanessa, who immediately recognized the young lady as one of the dancers from the show (her picture and name were on the program from the performance). Any doubts about her identity were dispelled by noticing the images on her phone that she was showing to her companion, all having to do with ballet and so on.

At some point the ballet dancer and her companion got off the bus and disappeared into the night.

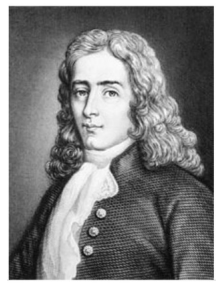
“Why would a dancer like this one, who performs in a naked-looking costume,” thought Gianluca, “take the bus? It would make more sense if she were picked up by a rich man in a Lamborghini.” (This thought, later verbalized, would result in severe criticism from Vanessa.)

But then Professor Baragatti reminded himself of the time when the Girls from Ipanema, as a concept, represented an impossible dream. He had even read something about that concept in a short story, *Cohesive Forces*, in a weird book called *The Quantum Decameron*, or something like that. He realized that now - and this was both bad and good - his feelings towards the Girls from Ipanema, as a concept, were more realistic and definitely fatherly, maybe even grandfatherly.

Of Good Samaritans

René Antoine Ferchault de Réaumur (1683-1757) was a French entomologist and writer who contributed to many different fields, especially the study of insects. He also introduced the Réaumur temperature scale, in which the freezing of water is set at 0º, while its

boiling point is set at 80º (unlike the more common Centigrade scale in which the boiling point of water is set at 100º).



René de Réaumur

Temperature is of course a very important quantity in physics, but it is also important for sex and reproduction, as anybody who has had his kitchen invaded by ants during a hot summer knows. This may be why Réaumur, an entomologist, got mixed up with temperature.

As with many other important people, Réaumur is honored in Paris by having a street named after him, the rue Réaumur in the 3rd arrondissement. The street crosses the Boulevard de Sébastopol, and is close to the Réaumur- Sébastopol Metro station, which is not named after the scientist, but rather from the streets nearby....

An interesting area of Paris

Now, you have to know that this area stands out on the map of Paris as a

hotbed of prostitution and is very popular with the femmes de nuit. As one can see from the map, the rue de Turbigo crosses both rue Réaumur and Boulevard de Sébastopol, and may also be considered part of the active nightlife of the district.

We bring up the Rue de Turbigo because of an unfortunate and sad incident which happened on that street on the night of January 19, 2022, not too long ago. It was a cold night, with the temperature dropping to about 37º F (about 3º C, or 2º on the Réaumur scale), pretty close to freezing. On that night, an 84-year-old man who was out for an evening walk, fell and hurt himself badly. What followed resonated all over the world, for two reasons.

First, the old man involved was a famous Swiss photographer, René Robert, who specialized in taking shots of flamenco artists. Second, although he was lying in a rather busy city street, nobody paid attention to him for about nine hours. By the time a homeless person acted as a good Samaritan and alerted authorities, the old man had died of hypothermia. His death became the subject of a media debate around public indifference to people living on the street. Just about every professional philosopher or sociologist and their kin felt compelled to write an article about indifference, and every newspaper in the world reported on the event. Here are some examples:

> Killed by **indifference**: France shocked by death on busy Paris street (The Guardian, UK)
>
> Le photographe René Robert, mort dans **l'indifférence** en pleine rue (Le Figaro, France)
>
> Cadere a Parigi e morire nell'**indifferenza** dopo nove ore (La Repubblica, Italy)
>
> Asesinado por la **indiferencia** (La Nacion, Spain)
>
> Fotógrafo suíço de 84 anos morreu por **indiferença** das pessoas (O Globo, Brazil)
>
> René Robert sei in der in einer Winternacht durch **Gleichgültigkeit** getötet worden (Der Spiegel, Germany)
>
> In addition, the Muted Inquirer, in Oligarchsburg, Russia, wrote at length about **Равнодушие**, while the Kung Pao Daily in Hungon province, China, discussed '**漠不关心**', and the Voice of the Faithful in Berserkistan printed an editorial

about 'لا مبالاة.'

*****

Professor Gianluca Baragatti read some of the newspapers quoted above and thought about the issue. "Why do people not act more frequently as good Samaritans?" he thought. "It is not just indifference, there is another component, and that component is fear of potential unforeseen consequences." And he could have been right, because the papers often report that some people who had tried to be good Samaritans ended up being robbed or worse. This reminded him of an event that had happened to him several years before.

It was a Sunday morning and Professor Baragatti was driving by himself to the Los Angeles airport, where he was supposed to pick up his daughter Vanessa who was flying in from Seattle. The pair would then drive to Santa Barbara to join the rest of the family for some kind of reunion. As he got closer to the airport, Gianluca realized that he had to make a telephone connection with his daughter.

Now, you have to know that Professor Baragatti has always had a strained relationship with telephones, and particularly so with those of the cellular kind. He wished that someone would make cell phones with a rotary dial, like in the good old days when you had to contact a nice lady at a switchboard to make a long-distance call. He also felt that telephone conversations should best be conducted in private, like other bodily functions. For this reason he turned into an empty commercial area and parked the car.

As soon as he pulled out his phone and tried to turn it on, Gianluca realized that the thing was restless and in a bad mood. In fact, taking advantage of its master's momentary distraction, the phone jumped out of his hand and dove straight into the narrow space between the driver and passenger seats. Gianluca tried to insert his hand into that space, all the while trying to convince the phone to be more reasonable, but all attempts failed miserably.

At this point Professor Baragatti got out of the car and laid flat on the ground while attempting to squeeze his hand underneath the front seat. He must have looked like he had passed out. By a combination of enticements and threats he was finally able to convince the phone to move to a position where he could grab it firmly. As he was holding the phone very tightly, he heard a voice inquiring, "Are you OK?" He turned over and saw a Black

man whose appearance suggested he might be living on the street and who had possibly emerged from behind a large trash bin nearby. But since Gianluca was holding a shiny metallic object, the man said, “Don’t shoot!” and backed away. Baragatti tried to explain that the object in his hand was a phone, not a gun, but by now the man had disappeared as silently as he had materialized.

In retrospect Professor Baragatti felt sorry that he had not had a chance to thank the man for showing some concern for his wellbeing. Similar to the Paris case, the person who had volunteered to be a good Samaritan was clearly not well off, and disregarded the fear of potential consequences, which could have included getting shot. As for the phone, it did its job by allowing a conversation between father and daughter, but for the rest of the day it kept up a smug attitude and seemed to be proud of its attitude.

We could probably write an opinion piece on the fear of potential unforeseen consequences as a factor in the scarcity of good Samaritan actions in modern society, particularly as it relates to gun availability in America, the Second Amendment, the National Rifle Association, and so on, and so on.

However, by a combination of indifference and fear of potential unwanted consequences, we would rather leave that job to somebody else.

Units of Measurement

Physics, like other areas of human activity, makes use of units of measurement. In fact, it is physics that is mostly responsible for the introduction and definition of those units. In the old days the main units, such as “kilogram” and “meter” were defined by physical standards kept in some fancy place, often in Paris. Today the basic units are all defined with reference to fundamental properties of matter, such as frequencies of radiation emitted by specific isotopes, and the like. Even the kilogram is now defined via a relationship that involves the Planck’s constant. Also, the development of science has forced us to use larger and larger - and also smaller and smaller - numbers, which has resulted in the introduction of convenient terminology. Therefore, the prefixes Kilo, Mega, Giga - and also milli, micro, nano, etc. - have been introduced.

The prefix Mega is well known today, due to the unfortunate proliferation of gadgets using terms like Megahertz and Megabyte. We hear often of the

stress of modern life which, unlike the stress in metal structures, is not measured in Megapascals. There is also the term Megadollar (that is, a million dollars); it is not used much, probably because today you need billions to get attention. In any case the term Mega will stay with us for a long time (unlike MAGA, which we hope will disappear).

*****

It was Friday, March 12, 2021. Professor Gianluca Baragatti was sitting on the couch, relaxing and preparing to solve the puzzles in his daily newspaper. His daughter Vanessa was sitting next to him. Gianluca opened the section titled WEEKEND, in spite of the fact that not much could be done on a weekend during a pandemic. Immediately, his jaw dropped. Then the following conversation ensued between him and Vanessa:

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GRAMMYS

FROM E1

time student after transferring to TSU and is completing her course load online to accommodate her music career.

SONG OF THE YEAR

Nominees: "Black Parade," Denisia Andrews, Beyoncé, Stephen Bray, Shawn Carter, Brittany Coney, Derek James Dixie, Akil King, Klim "Kaydence" Krysiuk and Rickie "Caso" Tice *(performed by Beyoncé)*; "The Box," Larrance Dopson, Samuel Gloade, Rodrick Moore, Adarius Moragne, Eric Sloan and Khirye Anthony Tyler *(performed by Roddy Ricch)*; "Cardigan," Aaron Dessner and Taylor Swift (performed by Swift); "Circles" Louis Bell, Adam Feeney, Kaan Gunesberk, Austin Post and Billy Walsh *(performed by Post Malone)*; "Don't Start Now," Caroline Ailin, Ian Kirkpatrick, Dua Lipa and Emily Warren (performed by Dua Lipa); "Everything I Wanted," Billie Eilish O'Connell and Finneas O'Connell (performed by Billie Eilish); "I Can't Breathe," Derrst Emile II, H.E.R. and Tiara Thomas *(performed by H.E.R.)*; "If the World Was Ending," Julia Michaels and JP Saxe *(performed by JP Saxe, featuring Julia Michaels)*

This category honors songwriters, not performers. That said, in the past decade, six of the Record of the Year victors have also won for Song of the Year. That could

MARCELO CANTU

Megan Thee Stallion had a banner year and is nominated for several Grammys, including Best New Artist.

G - What in the world is that?!!!

V - It is clear from the tone of your question how you tend to objectify women. You should say *who* is that, not *what* is that. By the way, she is Megan Thee Stallion, as the picture caption says.

G - Mega what? I do not recognize that unit.

V - It is not Mega, it is Megan. She is a rapper.

G - Oh, I get it. Although in this case the term Mega would not be out of place. Is she the one who married the prince?

V - Good Lord, no! That one is Meghan.

G - Megan, Meghan, Shmegan, to me it is all the same...

V - I heard that expression before, most likely in one of your silly and inconsiderate jokes, and I do not want to hear it again.

At this point Vanessa excused herself and joined Berenice in having a Negroni (1/3 Vermouth, 1/3 Campari, 1/3 gin). Vanessa was somewhat correct; she had heard a similar reference before. It comes from a joke that appears in many versions on the internet but usually takes place on a train and it involves some kind of conflict between a Chinese man and a Jewish man. We summarize it here to satisfy the legitimate curiosity of our readers:

(Train enters a gallery and the Jewish man slaps the Chinese man)

Chinese Man – What did you do that for?!

Jewish Man – That was for Pearl Harbor.

Chinese Man – Pearl Harbor? Those were the Japanese!

Jewish Man – Japanese, Chinese, Thailandese... to me they are all the same...

(Train enters a gallery and the Chinese man slaps the Jewish man)

Jewish Man – What did you do that for?!

Chinese Man – That was for the Titanic.

Jewish Man – The Titanic? That was an iceberg!

Chinese Man – Iceberg, Greenberg, Goldberg... to me they are all the same...

SETTIMA GIORNATA (SEVENTH DAY)
STORIES CONNECTED WITH PATRIARCHY

The stories narrated during this day are somewhat related to issues arising from the different perception of sexual interaction between the two original sexes. None of these stories involve Professor Gianluca Baragatti and his wife Berenice, possibly because they do not have these kinds of issues. Hopefully the stories convey the importance, for a balanced long-term ceasefire in the battle of the sexes, of a civilized behavior, without which no moral purpose could even be claimed. And of course, just like the other stories, they contribute to the unity of the book by having a connection, direct or indirect, to some aspects of the world of physics.

Consequences of an inscription in Latin on a Royal Spanish tomb. A Faustian trial for one of the most famous German poets. Reversals of fortune for two test pilots. Sex dolls in physics demonstrations and religious processions. These and other stories are narrated during this day.

Chitarra Romana

Martin Sanford was a professor of physics at a California university and had been teaching quantum mechanics for several years. He was a very humble person, not young anymore, was living alone, and could very well be described as colorless. His lectures were precise to the minor detail, but had no spark, and nobody had ever seen Professor Sanford get excited, or even surprised, about anything. So much so that his students had started to refer to him as “the excited state of the deuteron,” a thing that, according to nuclear physics books, does not even exist.

All this was destined to change after a young girl entered his classroom. Her name was Magda Astroski, and she was of Eastern European origin. The young lady was beautiful, well dressed, and made heads turn. Why was someone like her studying mathematics and physics? Some of the students, mostly males, commented later that her facial expression could be described (using their language) as a quantum superposition of an innocent state and a devilish state.

As time went by the students also noticed that the attitude of Professor

Sanford started to change. He became more adventurous with his dress code and started to devote more attention to Magda during his lectures. At certain times the class was invited to solve some problems, and the professor was seen to spend more time helping Magda than anybody else.

In spite of the extra attention received, the young lady was not making great progress with her studies. Therefore, Professor Sanford suggested that he could give her some private tutoring and invited her to his place, an apartment on campus where he had been living for many years. Things went downhill after that.

The population of the university recalls having seen Magda Astroski running away from Professor Sanford's apartment, screaming that the professor had made sexual advances on her (though perhaps they just heard about it). You have to know that this happened at the height of the ME TOO movement. The reaction to the event within the academic workplace was swift and furious. Martin Sanford was immediately dismissed and barely avoided being tarred by mobs screaming ME TOO! ME TOO! During this episode and the subsequent trial, which resulted in conviction, his only defense was continuously repeating: ME TOO OLD! ME TOO OLD!

After serving his sentence, Professor Sanford emerged in a deep state of depression. Someone suggested to him that he should take a trip to a different land. He had saved some money, so he booked a tour to Venice, a city that he had wanted to see since his youth.

So here he was, sitting at night in Piazza San Marco, drinking an expensive cocktail and listening to a long-haired young man singing Italian romanzas. And the trouble started when the singer intoned a very popular one:

O chitarra romana

Accompagnami tu

which, as any reasonable person would figure out, of course translates as

Oh Roman guitar

Accompany me

But Professor Sanford, because of his traumatic experience and also maybe because of the many years pondering quantum physics, was not now a very reasonable person. He did not know Italian, could not understand the lyrics in the song, and all he could make out was something like this:

Okitah raro manah

Ah komp nha **ME TOO**

Those verses are the main refrain of the song and not surprisingly they are repeated multiple times. The final syllables started to resonate in Professor Sanford's head with a dramatic crescendo. At the fifth repetition, he got up, emitted a painful cry, NOT AGAIN, and started running into the night. His body was recovered the following day in one of the stinky Venetian canals.

Mister Fritz's Day in Court

Mr. Fritz was sitting in court. He had been brought there by a combination of events both in his life and in the world at large. The events in his life, he felt, had not been that uncommon, but extraordinary changes had taken place in the world, to such an extent that it was difficult for him to fit in. The long war or battle of the sexes, which had raged for decades, perhaps centuries, was now unquestionably over, with the most decisive victory for women, and they were not taking prisoners. This is why he had been taken to court, although he was still uncertain about the charges.

There was some motion in the crowd, and the audience stood up as the judge entered the room. It took three hops for the judge to take his place. He or she was wearing a huge robe which could not disguise the huge hind legs and long tail. *Great, that's what I need*, thought Fritz, *a kangaroo for a judge*.

After the usual preliminaries, the proceedings started. Apparently, Fritz's wife had asked for a divorce, on numerous grounds, and was now claiming support rights. Because of the new laws, the situation was now treated as a criminal case. The major offenses were that Fritz had not been listening, and that on more than one occasion he had bought gifts, such as underwear or perfumes, that were considered to be self-serving.

Samples of the perfumes and of the underwear, properly catalogued, were presented to the all-female jury. The case was so compelling that the jury took no time in coming to a decision.

"Ladies and gentlemen," announced the forewoman. "This jury finds the defendant guilty and sets the monetary compensation to five billion dollars."

Fritz gasped. Five billion dollars! “Make that per month,” said the judge, “that will teach him. And let us continue.”

“Continue what?” Fritz asked his court appointed lawyer. She was a middle-aged woman, with facial features that reminded Fritz of a horse. *Maybe she is really a horse*, thought Fritz. *After all,s the judge is a kangaroo*.

“You will see, did you really think you could get out so easily?” answered the lawyer with a nervous laugh that showed her teeth. *Some defense lawyer*, thought Fritz.

A second woman plaintiff had now appeared, and the clerk was reading the accusation. The woman, Maddalena, many years earlier had been a lady of the night. During a visit to Milan, Italy, Fritz had picked her up in Corso Sempione, and they had spent a short time together in a cheap hotel.

Maddalena’s complaint was that by picking her up (in a small Fiat), Fritz had deprived her of a much better opportunity, namely being picked up later by a prince from Abu Dhabi in a Rolls Royce. With the help of a friend at the University, the woman had done some quantum calculations that showed the probability for the second event to be fairly high. To Fritz’s dismay, the jury, as well as the judge, considered the woman’s arguments to be very reasonable, and awarded her two billion dollars (every two months, clarified the judge).

Next came Sonia. She was a radiology technologist who conducted medical CT examinations. The consulting company for which Fritz was working at the time was performing maintenance on the equipment where Sonia was working. Fritz had once told her his theory which compared the Kamasutra (a serious ancient Indian text, but universally known only for its description of multiple sexual positions) to tomography. According to the theory, it all had to do with increasing knowledge, as defined in the Bible, where it says that Isaac *knew* Rebekah, and Jacob was born. Tomography gives you more knowledge than radiography, because you shoot x-rays from many different angles. Therefore, the use of many positions should increase *knowledge*, that is why Fritz considered the Kamasutra to be the equivalent of sexual tomography. In any case, listening to those specious arguments had caused Sonia severe psychological distress, and she felt entitled to compensation.

“My client has an objection,” said Fritz’s defense lawyer. “He says that the plaintiff was not naive at all. He says that she used to wear light blouses without a bra at the office, and that her breasts were…”

“Unsustained!” barked the judge.

“Exactly,” said the lawyer.

“I am referring to your objection, not to the boobs of the plaintiff,” said the judge pointily.

The audience was very sympathetic to Sonia’s plea. They found her complaint very reasonable and awarded her three billion dollars (“every week,” said the judge, “that will teach him to object.”).

After Sonia, a number of women testified against Fritz. On different occasions and at different points in his life, Fritz had looked at them with lust, or so they thought. All of them came away with substantial monetary awards. Some of the women had actually put their picture on the Internet, in various states of undress, as part of their working career. Fritz had shown the audacity of using his home computer to spy on them. Obviously, they were also entitled to compensation.

Another woman was a serious scientist. She worked at the Institute of Physics at the local University, and she had made important contributions to string theory. Fritz had met her at a party and, after learning about her interest, had made some stupid comment about string bikinis. She came away with the biggest award.

Fritz was discouraged. He whispered to his lawyer: “Couldn’t you get some favorable testimony on my behalf? Like from my mother?”

“Shut up, you mother#$%@&!” said the lawyer. “You should be grateful that I was able to settle with her out of court, that is why she is not here today suing you.”

*****

Fritz woke up shaking and sweating. His wife was looking at him. “How much are you suing me for?” he asked feverishly. “I am not suing you for anything, darling,” said his wife patiently. “But you should try to drink less at night.” For once, Fritz was listening.

The Trial of Johann Wolfgang von Goethe

If you were to ask the question about who is the most significant author in the English language, many people would likely say William Shakespeare.

Change that to Italian and the answer would likely be Dante Alighieri. For Spanish, Miguel de Cervantes, and for Portuguese, Luis de Camões. Harder to get a single answer for the French language. But for German, the answer is definitely Johann Wolfgang von Goethe, the author of *Faust* and other celebrated writings, including *The sorrows of young Werther* and *Elective Affinities.* And, also, the *Marienbad Elegy*, written in his old age after falling in love and being rejected by the young Ulrike von Levetzow.

Johann Wolfgang von
Goethe 1749-1832

The tragic play *Faust* consists of two parts. The first part is the most well-known, and has been widely performed and turned into operas. If we were to replace the devil with a human being, and the pact with something tangible and profitable, the entire plot would be fairly realistic. The second part, which is longer, is much more detached from reality, since it oscillates in both space and time. The scenes change from ancient Greece to the Middle Ages, the character Faust even has a son with Helen of Troy, and mythical as well as past historical personalities enter and exit the play. The following story attempts to follow that format, which includes choruses sung by weird creatures.

Ulrike von Levetzow
1804-1899

*****

The trial takes place in a clearing within the Amazon Forest. All sorts of creatures are present. The judge is a monkey with a long white wig. Goethe sits at the defendant table, next to his attorney. The jury is composed by all of the animals represented in *The Magic Flute*.

JUDGE: Herr Goethe, you came to Brazil thinking that you could evade justice. It is true, many former Nazi criminals have managed to find new identities in our vast country. While you are not one of them, you *are* facing three counts of instigating, through your writings, acts which have negatively impacted the economy, science, and race relations. And you also face an additional count of sexual harassment in your private life. Several witnesses will detail the accusations against you.

PROSECUTOR: Herr Goethe, most of your life was spent in the city of Weimar. In the second part of your famous poem (Act I, Scene IV), Faust and his associate Mephistopheles urge the Emperor to issue huge amounts of paper money, which later results in ruinous inflation followed by a war. It is not a coincidence that in what we now call the Weimar Republic, after World War One, there was tremendous inflation, followed by the ascent of Hitler and another world war. We consider you responsible for suggesting that such a thing could happen. Furthermore, the term Weimar Republic has been used in many articles to describe the decadence of democracy in the United States, which led to a failed insurrection (the prosecutor lifts up and shows copies of the New York Times). We consider you responsible for that too.

CHORUS (*Dejected Trump supporters, led by Rudy Giuliani*):

As loyal patriots we were viewed,

and ended up being screwed ...

MAGA MAGA MAGA...

ISAAC NEWTON: In 1810 you wrote a book called *Theory of Colours* in which you viciously attempted to discredit my theory of light. You must know by now that my ideas have been to some extent vindicated by modern science. With all due respect, Sir, your so-called theory stinks and may only be appreciated by cubist painters and the like. You should have limited yourself to the field of literature and not tried to invade the field of physics. You should be held responsible for the demeaning of true science.

CHORUS (*Nuclear physicists, led by J. Robert Oppenheimer*):

Elemental transmutation, Copenhagen interpretation,

fission, fusion, quantization,

blah ... blah ... BLAST

ALVIN WEINBERG (nuclear physicist): In 1947 I was the director of Oak Ridge National Laboratory and I was the first one to use the term *Faustian bargain* to describe nuclear energy. That characterization, which would not have been possible except for your play, carried some weight in the rejection of a form of energy that can actually help fight global warming. You must carry some responsibility for that.

CHORUS (*Young Swedish girls, led by Greta Thunberg*):

Ahhh Sooo... Ahhh Sooo...

Saving the planet, here we go ...

MARTIN LUTHER KING JR.: Our distinguished friend, Sir Isaac Newton, rightly criticized your writing from a scientific standpoint. But I want to go back to what you wrote in your *Theory of Colours* regarding the impact of colors, which you consider to be subjective anyway. I quote:

Lastly, we might here consider ... whether all human forms and hues are not equally beautiful. We venture ... to assert that the white man, that is, he whose surface varies from white to reddish, yellowish, brownish ... is the most beautiful.

Sir, you are a racist! And you should be held responsible for writings like this that encourage violence, debasement, and harm toward others.

CHORUS *(Throng of demonstrators, led by Oprah Winfrey):*

Days and nights we will utter

That Black Lives Matter.

From Atlanta to Bethlehem ...

BLM ... BLM ... BLM ...

ULRIKE VON LEVETZOW: Goethe, when you were seventy-two years old you wanted to marry me, yet I was just a seventeen-year-old girl. You even used your status and your influence with the Grand Duke Karl August to advance your proposal. Do you know what would happen to you and your reputation if you tried that today? Obviously, I turned you down, but you had the gall of writing poetry about your pain and misery after the rejection. I lived a long life and I never married, but I do not hold you responsible for that.

CHORUS *(Women, led by lawyer Gloria Allred)*:

Onward girls, we have work to do

Me too ... Me too ... Me too ...

JUDGE: Herr Goethe, I think we have heard enough. Let the jury decide on your guilt or innocence.

The jury retires behind the trees, does their business, and returns shortly after with a verdict. Johann Wolfgang von Goethe is found guilty and will be released to the custody of Mephistopheles.

MEPHISTOPHELES: Finally, justice is done! Herr Goethe managed to save his character Faust, but at the end he could not save himself. Come down with me, baby.

An old man suddenly appears.

GIUSEPPE VERDI: Fermi tutti! Everybody stop! I respectfully ask the Court to consider a redeeming feature in Act I, Scene II of the second part of Faust. You will find words that represent the regressive position of the Church regarding human nature and enlightenment, such as

Nature is sin, and Mind's the devil ... Nature and Mind are heretics ...

The Saints ... and the Knights ... defend the throne ...

Those words also expose the alliance of military and religious institutions in supporting dictatorships, as illustrated by the below image from the time of the Spanish Civil War. Artists who criticize this kind of unholy alliance, including Signor Goethe, should be praised. I am proud that, in the final act of my opera Aida, a similar critical sentiment is expressed, and directed against the Egyptian priests who are demanding the execution of the tenor (I mean the hero).

Elective affinities in the Spain of General Franco

BOOMING VOICE (from above): Bravo Giuseppe! Johann Wolfgang is saved!

> *The Triumphal March from Aida is heard, amid clouds of incense and sulphur.*

MEPHISTOPHELES: Damn, I have lost again! But I will be back!

CHORUS (Angels, led by Cherubim):

> Roses and violets, holy water,
>
> They go lower, we go higher...

CHORUS (*Devils, led by Lucifer*):

> Poison ivy, holy shit,

They go higher, we better split...

Invenit Mulierem Bbonam

In the English language the adjective usually goes in front of the noun. In the Italian language the adjective may be in front of or after the noun, sometimes with different meanings. For example, I have more than once read in travel articles that in Rome you can find a bank of the Holy Spirit, which indeed would sound funny. That is not true, there is not such a bank. It is true that there is a *Banco di Santo Spirito*, because Santo Spirito (also known as Borgo Santo Spirito) is a district of Rome, but there is not a *Banco dello Spirito Santo*, which would in fact be a Bank of the Holy Spirit. Similarly, there is a difference between *a donna buona*, a good woman, and *a buona donna*, like in *figlio di buona donna*, which is a gentle euphemism for "son of a bitch." ***B****uona* is a feminine adjective meaning "good." In the Roman dialect they say *bona*. However, if they say *bbona* in reference to a lady, it is indicative of an extremely attractive physical appearance.

*****

Marco and Tullio were twins, born and educated in Rome. Their father had been a well-known scholar specializing in the Latin language and had published a study on the famous Roman senator and orator Marcus Tullius Cicero, which explained the names given to his sons. Marco and Tullio were now about twenty-two and were enrolled at the University of Rome. Unlike their father, they had no interest in the classics. Marco was studying physics, and Tullio was pursuing a degree in mathematics.

At this particular moment in the summer of 1968, the two young men were in Spain enjoying a two-week vacation. While their destination was Costa del Sol, they had decided to get some culture before arriving there and relaxing in the sun. That is why they were now visiting the Escorial, not far from Madrid. The Escorial is a very large complex where Spanish kings, princes, and their spouses are buried. Lots of fancy tombs, plenty of marble, mostly baroque style. Just as the two young men were getting saturated with the funerary displays and were heading for the exit, one of the tombs attracted their attention. The inscription on it, in Latin, read:

Qui Invenit Mulierem Bonam Invenit Bonum.

Marco and Tullio had no problem understanding the meaning of the sentence, which is part of a proverb in the Old Testament. A good translation of the sentence above is:

He who finds a good woman
has found the best of all things.

The two young men looked at each other and started laughing. “I know what you are thinking,” said Tullio. “The inscription should have said *bbonam*, not *bonam*.” They had a hard time controlling their hilarity, and they left the Escorial getting some dirty looks from fellow tourists as well as custodians.

For the rest of the trip the sentence “*invenit mulierem bbonam*” was a source of hilarity for them. When they finally were in Torremolinos, Costa del Sol, Marco would go for a walk along the beach and Tullio would ask him: “Did you invenit mulierem bbonam?” To which he would answer: “Invenit, invenit, I found many of them, the only problem is they did not invenit me…”

At the *pensione* on Costa del Sol where they were staying the two young men started a conversation with an old gentleman who was also spending some time there. He was a retired French military officer, Colonel Lamarche, who was accompanied by a young female whom he introduced as his niece. However, after accidentally hearing some comments from other guests at the *pensione*, Marco and Tullio came to the conclusion that the old man had “*invenit mulierem bbonam.”*

One day at dinner the subject of the war in Vietnam came up. Remember, this was 1968, and the war was at its peak. In previous years Colonel

Lamarche had been stationed in Indochina, and he had a strong opinion on the situation. “The Americans,” he said, “are not applying enough force. They should squeeze the insurgents and apply more pressure.”

“My dear Colonel,” said Marco, the student of physics, “With all due respect, like most military men you are applying a wrong model. You view the situation as a gas consisting of atoms or molecules in a confined vessel. In such a case, when you reduce the volume, or ‘squeeze,’ as you say, you indeed apply more pressure on the constant number of atoms or molecules. However, I see the situation in Vietnam as a vessel containing radiation, or photons, if you like. You cannot squeeze radiation. If you try to do so, the number of photons will decrease, and the pressure will not increase. And that is just what happens with the insurgents who, like the photons that are absorbed by the walls of the vessel, disappear within the general population when you apply more pressure. Again, you cannot squeeze radiation as you do with matter.”

“Physics, physics,” said Colonel Lamarche. “You cannot win a war with physics.”

“Just tell that to the Japanese…” said Tullio.

*****

Two years later Marco and Tullio had finished school and were both working at the University, although in different departments. They took a vacation together and went to Brazil, where mythological Greek, and Roman names are very popular. While in Rio, they both *invenit mulierem bbonam*, and ended up tied to women with good old Roman names, Livia and Flavia. Their family insisted on religious marriages, at which they were blessed by the Holy Spirit. After that, they lived happily in the Spirito Santo district in Rome.

Unintended Consequences

It is a fact that our actions sometimes have unintended consequences, as the story you are about to read will illustrate.

Julius and Adrian were two young men working on their PhDs in physics at the University of X. They were both extremely intelligent, and in many ways they were different from each other. Julius was filthy rich, and an

extrovert. He had something in common with the young J. Robert Oppenheimer. He was outgoing and interested in women. And also, the first initial in Oppenheimer's name stood for Julius, a name that the head of the Manhattan Project inherited from his father, and one he hated and never used. In contrast, Adrian was shy, introverted, not rich, and had something in common with the young Paul A. M. Dirac. Also, the first initial in Dirac's name stood for Adrien, a name imposed by his French language-obsessed father. While Julius was easygoing and perfectly at ease with the opposite sex, Adrian was a misogynist, essentially afraid of women.

In spite of these differences, the two young men were friends and constantly challenged each other with problems and paradoxes based on physics (classical, quantum, relativistic, whatever).

One day Julius begged Adrian to come with him on a double date. Julius had to insist multiple times to finally get Adrian to accept, making up excuses as to why it was so important for him to go along. Eventually Adrian agreed. "Perfect," said Julius, "I will pick you up tomorrow night at seven p.m. at the University."

The following night was cold and dark; indeed, it was winter. The luxury car Julius was driving came to a screeching halt. "Get in quick," said Julius. Adrian climbed in and found himself in a soft and warm darkness. He sat in the back seat on the left side, just behind Julius. As his eyes adjusted to the darkness, he made out that there were two women in the car, both on the right side (one in front, and one next to him in the back). Adrian could vaguely sense that the two creatures were exceedingly shapely, skimpily dressed, and overly perfumed, all things that heightened his sense of fear. He retreated as much as possible to the left side.

"These are Irina and Natasha," said Julius. "They are from Russia."

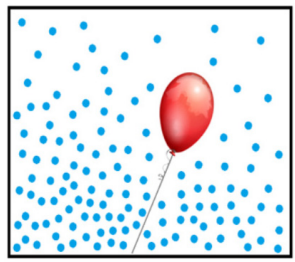
The car made a sudden jump forward, what one would call a jackrabbit start, and Adrian was pushed back into his seat. Interestingly, his companion instead seemed to spring forward. Julius was driving fast now and did not reduce the speed as he came to a curve. He made a sharp turn to the right, which pushed poor Adrian all the way against the door to the left. His companion, however, moved all the way to the right.

"Obviously she does not like me," thought Adrian.

The car now approached a curve to the left, and again entered at high speed. Adrian again felt his body pushed even further by the (apparent)

centrifugal force, this time to the right. And this time he made contact with his companion, who had moved in his direction. As this strange behavior continued for all the curves encountered, Adrian also noticed that the two occupants in the front seat seemed to be moving in unison, both left and right.

“It appears those two seem to be way more compatible,” thought Adrian.



The air molecules are accelerated to the left. The helium ballon moves to the right.

The car had now reached a populated area and came to a screeching halt. Adrian was thrust forward while his companion snapped back into her seat. And, as Julius turned on the lights, everything became clear to Adrian. The two creatures inside the car were not real women, but inflatable sex dolls.

“But why,” cried Adrian, “did you fill this one with helium?!”

“That was the whole point, to conduct a physics experiment. I wanted to check that the air, heavier than helium, feels the centrifugal force, so to speak, and forces the helium, lighter than air, to move the opposite way.”

“Jesus, you could have done that with a children’s birthday balloon.”

“I know, but that would not have been as much fun. I do compliment you for figuring it out right away. Were it not for the safety belt, she would have been floating up to the roof of the car.”

“Okay, but now what are we going to do with these things?” asked Adrian.

“We are going to deflate them,” said Julius, “and tomorrow I am going to donate them to the Convent of the Fellows of the Hidden Saint. Those reverend fathers can put them to a good use. Now let us head into the restaurant and meet our real dates.”

The two young men entered the restaurant where two young women were

waiting for them. Martina and Fabiola did not share all the attributes of the Russians, but they were cute and intelligent, and all four of them had a great time. This was a good therapy for Adrian, who lost his fear of women and became almost normal.

*****

This story could have ended here, but there would be no unintended consequences. So, stay tuned.

Unknown to our characters, a security camera in a local business had recorded their actions. Just a portion, actually, for less than a minute, after which a delivery van parked in front of the camera and obstructed its view. But that short clip, when reviewed by the security personnel at the business, was sufficient for them to contact the police. When Inspector Hans Kuff viewed the video, he exclaimed: “We have to capture those monsters! It is unbelievable what they did to those poor women. They literally took their breath away.”

So, an investigation was started, looking for witnesses. The young women Martina and Fabiola were known by the restaurant staff (actually one of them was the niece of the restaurant’s owner), and through these connections the police quickly arrived at Julius and Adrian who were promptly arrested. On the strength of the video, a judge set bail at one billion dollars; even rich Julius could not raise that amount quickly, so the pair was kept in jail. Eventually, the guys told the entire story, which was met with disbelief.

Inspector Hans Kuff contacted the Convent of the Fellows of the Hidden Saint to verify their story. Here is a partial transcript of the conversation between the inspector and Reverend Timotheus, who was the Father Superior at the Convent.

Inspector Kuff – Father, I would like to verify that your Convent received a donation of two ... uh ... sex dolls.

Father Timotheus – Inspector, we are a large operation and I am not familiar with all the details. I will check with my staff and get back to you.

(Irina and Natasha were subsequently found to have been stored, in a state of partial deflation and disarray, in a communal prayer area of the Convent.)

Father Timotheus – Inspector, yes, we had that donation and, as is our

custom, we used it for the major glory of God. Our brothers are very smart, handy, and crafty. They modified the dolls to take away the most offensive features, using rubber patch kits intended for repairing the inner tubes of old tires. They then painted the creatures to look like angels. They will be filled with helium and will be part of our next procession in honor of the Hidden Saint.

Inspector Kuff –Thank you Father. We will close the case and release the suspects.

*****

There were two unintended consequences in this story. The first one is that Irina and Natasha, now looking like angels, wound up floating above a huge procession, in a vertical position, rather unlike the one they had been originally designed for. The second unintended consequence was that the two real young women, Martina and Fabiola, never believed the scientific justification for the dolls and determined that Julius and Adrian were unredeemable perverts.

A Velocity Spectrum

In the old days it was a common belief, at least in Italy, that classical studies were in general more important than scientific studies in the formation of an individual. The famous nineteenth century astronomer Giovanni Schiaparelli wrote in a book introduction that he studied Greek (ancient Greek that is) later in life, because without knowledge of that language no one can declare himself (or herself, or themselves) a person of culture. Things have changed and we believe that today some knowledge of science, especially physics, is essential for an improved appreciation of important aspects of life, as described in the following story.

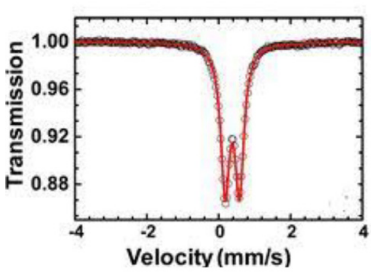
*****

Oscar de Martini was born in Milan, Italy, and grew up there, in a “traditional” family. His father was an engineering professor at the Polytechnic University, and his grandfather had been a famous mathematician. The history of the family, including uncles and cousins, had been oriented in the direction of the exact sciences (except for an aunt who had run away to Paris with a shady character, but the family did not want to

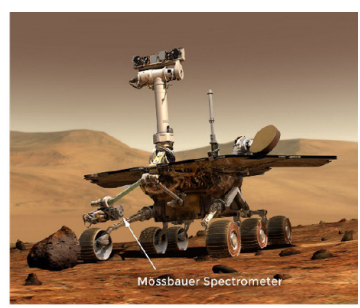
talk about that). In spite of the family background, however, Oscar was more interested in the arts. Had he followed his inclination, he would have probably pursued classical studies. But his father had a strong personality and convinced him otherwise. Accordingly, Oscar, who did not want to go against the paternal authority, enrolled and started taking courses at the physics department of the local university.

In 1961 Rudolf Mössbauer received the Nobel prize for having discovered, four years earlier, you guessed it, the Mössbauer effect. It should not be surprising that, five years later, when Oscar was completing his studies, his thesis was based (guess again!) entirely on applications of that effect. At this point we need to say a few words about it.

Briefly, the Mössbauer effect is a nuclear process permitting the resonance absorption of gamma rays. It is possible because the atomic nuclei are fixed in the lattice of solids so that energy is not lost in recoil during the emission and absorption of radiation. It is implemented by moving a source at varying speeds and measuring the transmission. One thus obtains a velocity spectrum whose features depend on subtle details, configurational and magnetic, of the atom's environment. For this reason, in recent years Mössbauer spectroscopy has become an important tool in the identification of minerals. In fact, Mössbauer spectrometers have been mounted on the rovers for the exploration of Mars, providing information on iron-bearing rocks.



Example of
Mössbauer spectrum



Mössbauer spectrometer
on Mars Rover

Back to Oscar. For a few months after his graduation, he continued working at the University producing velocity spectra. He even published a paper based on the results from his thesis. But soon he got tired and realized that a career in that field was not for him. After a while, finding more details on the environment of atoms in crystals did not seem too

exciting and he also felt some resentment towards his father for pushing him in that direction.

Eventually, through some acquaintances, Oscar de Martini got in touch with a group of people in the film industry. After writing a script that was well received, he became more and more involved in the cinematographic field, and he actually became a director, or what in Italy is called a *regista*.

One day he was directing a movie, and they were shooting a scene in which a sexy young woman was filmed from behind while walking along a tree-lined road. Suddenly, Oscar realized that there must have been an optimum walking speed that would give the best artistic effect. So, he had the young lady repeat the scene multiple times, walking first slowly, and then gradually accelerating.

That evening, after the sun had gone to sleep and a full moon was holding a political rally for wolves and vampires, Oscar sat down to review the different takes of the walking scene. He realized that his collection of records was in fact a "velocity spectrum," not unlike those he had been working on in his science days. And, guess what else! There was something similar to a resonance, that is a velocity at which the details of the system - not just configurational and magnetic, but also its dynamics - were emphasized, with the best overall artistic effect.

Oscar was reminded of his work on Mössbauer spectrometry and realized that his scientific knowledge gave him an advantage in the way he looked at the world. For the first time in his life, he felt that the time he had spent studying physics had not been wasted and was actually an asset. He also stopped resenting his father, who had pushed him into those studies.

Although the movie by Oscar de Martini did not win an Oscar, it was widely praised by the critics who described the walking scene as a "memorable one."

Approximations

Two old Italian physicists were eating dinner in a restaurant in Santa Monica, California. They had come to this particular establishment because one of them had read a review stating that in this place you could find "real authentic Italian cuisine." Also, according to the reviewer, nothing would be more effective in making one feel like he was in Italy than eating a meal at this place. Restaurant reviewers write these sorts of things all the time, in magazines and newspapers.

The two men (yes, they were men) began looking at the menu. The waiter brought them glasses of water with ice, and poured some oil and vinegar in a little plate, to be used for dipping the bread that he also set on the table.

"Here are two approximations already," said one of the men. "I have never seen this in Italy."

They proceeded to order "spaghetti a la Carbonara" and "linguini a le

vongole." "Another approximation," said the second man. "It should be *linguine*, not linguini, since lingua is feminine."

After the food arrived, the two gentlemen discovered more and more approximations. The Carbonara was good, but… it was made with bacon. Good bacon, sure, but not *pancetta*, and not as authentic as if it had been made with *guanciale*, prepared from the pig's cheek. As for the linguini, or linguine, the vongole were not the *vongole veraci* that you get in Naples, but baby clams, probably from Thailand.

I forget what other approximations the two men discovered, certainly something about the wine, and they kept talking about it. While they were going over this approximation business multiple times (old men like repeating things, just ask their wives), the waiter was occasionally coming around to check on them and kept bringing more water and ice.

At the end of the meal, a very charming young woman appeared at the table. "Gentlemen," she said, "Allow me to introduce myself. I am the chef in this restaurant and I am responsible for the preparation of your meal. Our waiter, who understands Italian, has informed me of your comments on our refined food, which in your opinion seems to be an approximation, maybe multiple approximations. He also told me that, from your other subjects of conversation, you appear to be physicists."

"In that case," she continued, "let me tell you something about approximations. In physics, you do approximations all the time. To solve a complicated Schrödinger equation, for example, you use perturbation theory, don't you? That is an approximation!" And she went on and on listing approximations in quantum theory: the WKB approximation, the random phase approximation, the closure approximation, the adiabatic approximation, the quenched approximation, the harmonic approximation, the one-phonon approximation, the Gaussian approximation, the Born-Oppenheimer approximation, and some more that we have forgotten. She also mentioned the reactor physicist, we forgot his name, who introduced a spherical, homogenized cow approximation to model the production of milk…

"The Born-Oppenheimer approximation," said one of the physicists, "I vaguely remember. Do you really know what that is?"

"Why, that's easy. It is the assumption that you can separate electronic and nuclear motions. If you prefer, the kinetic energy of the electrons is considered part of the potential energy of the nuclei."

“Wow!” The two old men were flabbergasted. “How does she know so much?!”

“Gentlemen,” continued the chef, “I can see that you are visibly shocked about my knowledge. Is it because I am a chef? Or because I am a woman? Or maybe because I am Black?”

They were entering dangerous territory. The two men looked at each other, until the oldest one said: “No, no, no… it is because you are so young.” Thirty or forty years before he would have said “it is because you are so young and so pretty,” but in this day and age you could not say things like that anymore.

The chef smiled. “You Italians are always flattering. I am not as young as I look and I know what you are thinking. Besides, I am sure you are aware of the term that was used to describe the beginning of quantum mechanics, *knabenphysik*, or boy physics. With good reason, since in 1925 Heisenberg, Jordan, Pauli, and Dirac were respectively 23, 22, 25, and 22 years of age. Had I been there at that time, maybe they would have called it *mädchenphysik*, or girl physics… In any case, to show you that I am not resenting your criticism, I will offer you a dessert on the house. It is my approximation to Tiramisu.”

“Why is it an approximation?”

“It has some elements that come from fusion with Japanese culinary tradition. Hence the name of the dish: Tiramitsubishi!”

Stress

This story is about a man by the name of Karl. He had been born in Germany, more precisely in the region that used to be Prussia, and had received a rigorous education. Since he was inclined to study the exact sciences, he had obtained a degree in physics, but his work had gradually shifted from pure science to applications of it. He had worked for some time in Italy, where the Mediterranean atmosphere had somewhat softened his Germanic personality. As a consequence, although his legal name was Karl, he preferred to be called Carl. Sometimes, answering the phone from someone who wanted to talk to Karl, he would say: “I am sorry, Karl is not here. I am Carl, can I take a message for Karl?”

Karl, or Carl, had then moved to the United States. He was now about forty

years old and was working for a company that, among other things, was developing techniques for nondestructive testing of materials. Thus, for the time being, he was investigating methods for measuring stress in steel, ultrasound, magnetic noise, micro hole drilling, x-rays, whatever. He had also gotten married to a woman who insisted on calling him Karl.

At the moment, Karl was flying from San Diego to Boston to attend a conference on, you guessed it, stress. To be precise: "Control of Stress in Materials." He was sitting next to a young woman of average appearance, meaning that, like most of us, she was neither wondrously attractive nor particularly unappealing.

At some point in the flight Karl wanted to check something, so he took the conference program out of his bag and started flipping through it. The young lady next to him must have noticed some words in the title of the program, such as "stress" and "control" (she had not noticed "materials"). Suddenly her eyes lit up and she looked at Karl like she had found the Messiah. At that moment she looked very attractive.

"Stress? Stress control? You work on that?" the young woman blurted out. "But this is the most important issue in our time, what with all that goes on in the world… You must…" She paused in admiration. After his initial surprise, Karl patiently and technically explained to her that he was not dealing with stress in people, only in lower entities such as steel, definitely a more boring area. At this explanation the young lady was extremely disappointed and assumed an expression of disgust. It did not help that Carl (yes, Carl) pointed out in the nicest way that excessive stress could cause steel to break, and a bridge to fall, and people to die, and thus create stress on people. The young lady was not convinced and reassumed a somewhat sad and cold appearance. She was not attractive anymore.

*****

After the conference Karl was flying back to San Diego. Coincidentally, this time he again happened to sit next to a young woman. Maybe not as young as the previous one, but she was elegantly dressed, stunningly beautiful, and very attractive. As it turned out, she was a recent divorcee who had gone through a lot of stress trying to extract as much money as possible from a rich and stingy (ex) husband.

The flight was almost over, and Karl was thinking about the conference. He could not remember the name of a German who had presented a paper just after his (that damn Prussian had implicitly criticized him and called him

Karl), so he took out the conference program again. And, guess what, the lady next to him took notice of the words “stress” and “control.” Her eyes did not increase in luminosity and she did not become more attractive, she was already attractive enough. But she took notice of Karl, maybe of Carl.

This time Karl did not want to disappoint her. Maybe if she knew the truth she would turn ugly. What did he know about women? After all, he only had one data point. So, he mumbled something answering her questions about stress in people. The plane was landing anyway and the lady said she would want very much to talk to him again, about stress of course, so she gave him her phone number. And Karl told her that she could call him Carl.

*****

Over the next few days Karl bought several books on human stress. How to deal with stress, the upside of stress, stress free living, stress proof, how to handle stress, success under stress, stress less, stress reduction, stress for dummies, stress management, stress for idiots, these were some of the titles. He figured that with his newly acquired knowledge he could keep talking to the woman he had met on the plane. Then one day he gathered up the courage to call her. Pretty soon she figured him out (women always figure out everything), but she liked him anyway. Eventually this developed into a full-time affair, for which both Karl and Carl were not emotionally prepared. Having a double life, being called Karl at home, and Carl in another house, was too much for the poor man, and he died of stress.

Luckily, he was cremated, so there was no need to write his name on a tombstone. But in all the speeches at the ceremony he was eulogized as Carl.

The Test Pilots

Mankind has created and continues to create a number of things, most of which we could do without. In any case, before these things are perfected and marketed at large scale, they need to be subjected to a number of tests, and professional people do that. It so happened that two old men, Roberto and Daniel, who had been test pilots in their young age, were getting together to drink wine and share their past experiences. It is not clear where and how they were meeting, because they had different nationalities and

their life spanned different historical periods, but they had one thing in common.

Both of them, at some point in their lives, had fallen on hard times, for a number of different reasons, although the main one could be traced to relationships with women. Therefore, they could not continue to be test pilots anymore. They had been forced to scrape together a living by using their acquired expertise for testing - if not for flying machines, for other products of human ingenuity.

Roberto was Italian, and had been one of the first test pilots. He had personally known all the pioneers of aviation: the Wright brothers, Bleriot, Santos Dumont, to name a few. For a number of years he had been a test pilot for the Fiat and Caproni companies. At the beginning, he had been very lucky in his marriage. His wife was very beautiful and Roberto was very proud of being seen with her. She was also smart and very careful with spending money, she was not wasteful. Because of these characteristics, Roberto made the mistake one day of referring to her as a "low maintenance trophy wife." In his mind this characterization should have been very complimentary. Unfortunately, his wife did not like the expression and took offense. Since she had a quick temper (probably traceable to her tropical origins), she left him. Roberto was shattered, fell into a deep depression, and began to drink heavily.

Since the economy was in recession it was difficult for him to find a job. Eventually, he became a tester of theories of quantum mechanics at a major university. Quantum mechanics is based on probabilities, and in those days there were no computers to generate pseudo random numbers to use in Montecarlo codes, so Roberto was spending days and days just throwing dice and recording the results, which were then used by the scientists to confirm their theories or to disprove those of their colleagues. It was a very boring job, and he tried to complain about it but his employer told him: "Do you know what Einstein said about quantum mechanics?" He said, 'God does not play dice.' Well, Einstein was apparently proved wrong, so God must actually play dice, therefore you should consider yourself lucky to have a Godlike job, even though it does not pay much."

Because of the boredom Roberto eventually got married again and this time he was very unlucky because the new wife, besides being less attractive, turned out to be very high maintenance, and, before disappearing, left him penniless. Roberto started to drink again and drifted to where he was now.

“Well, I probably was the one with the worse experience,” said Daniel, who was American and had been a test pilot for an aerospace company building jet fighters for the Middle Eastern market. His problem had not been one woman, but multiple women. Since his job was in one of the bases in Nevada, he had started going to Las Vegas and had developed a passion for gambling. In doing so, and with the help of several women, he had progressively lost all his money. Eventually, when all this had become public knowledge, he had lost his security clearance and then his job.

“When I fell on hard times,” recalled Daniel, “the economy was also in recession. Because of my past experience, I was lucky to find a job at a paper producing company, as a tester of toilet paper. It was a messy job and frankly kind of degrading. Because they wanted the product to be versatile and adequate to different conditions, my contract specified that I had to try all kind of diets, including extremely spicy ethnic foods which occasionally ended up upsetting my stomach. The only time I had some fun was when I briefly participated in an aborted project alongside Ingrid.”

“Ingrid,” Daniel continued, “was a pretty, although not very smart, Swedish girl who was working as a tester for the facial tissue line. The company had recently hired Jerry, an advertising man who had been responsible for creating a very successful TV commercial for a brand of paper towels. The commercial showed the amazing performance of the paper towel in cleaning up all kinds of dirt, and compared it to the disastrous performance of a competitor’s product. The ad had dramatically improved sales, and Jerry thought that he could do a similar thing with toilet paper. In his mind, Ingrid, who had beautiful manicured hands with lacquered nails, would handle our product, while I would demonstrate the messy result by using whatever the competition was marketing. As soon as the Board of Directors, which was known for its conservative values, got wind of the project, there was a big uproar, resulting in Jerry, Ingrid, and myself being fired.”

“After that, and again because of my previous experience, I got a job with a Japanese company that was introducing automated, self-cleaning toilets. The work was somewhat similar to the previous one, except that there were some painful moments when the engineers, in their efforts to optimize the products, were adjusting the temperature of the water, steam, and air jets responsible for the cleanup function. I heard that the company had previously marketed a model based on a mechanical system, but the system turned out to be hard to control and had resulted in a number of lawsuits.

On the bright side, I am proud to say that for the models which I had tested there was never a need for a recall. At some point in time, I became too old for that kind of work, the company needed more diversification for their testing needs, so they hired younger people and they let me go."

Roberto and Daniel went back to reminiscing about old times. They ordered more wine and sheets of paper, which they used to build paper airplanes that they proceeded to test thoroughly. The airplanes floated smoothly in space and time.

The Story of Filet Mignon

Filet Mignon Liebenbraten was born in Paris in a family of German ancestry. She was born at the height of La Belle Époque, a period when great discoveries were being made in the physical sciences, and when there was a great expectation that soon everything would be understood and explained. It was not clear why her parents had given her that name, but as Filet Mignon grew up, no one would have said that the name did not fit her. In addition to beautiful hair and skin, she had a voluptuous body, with perfectly shaped breasts and buttocks.

Although she had many suitors, Filet Mignon was a serious girl, a *rare* thing in those days, and she was studying physics at the Sorbonne. At that stage of her life, she did not yet appreciate the gifts that she had been endowed with, and was possessed by an idealistic quest for knowledge. Accordingly, she became infatuated with one of her teachers, Professor François Pourdevin, who was teaching physics at the Sorbonne, and who turned out to be an old goat. Pourdevin was from the old school. Although he had done brilliant research in his young years and had collected many recognitions, he was attached to his past and rejected the new ideas of quantum science that were being developed in those years (the 1920s) as temporary frills.

For Professor Pourdevin, Filet Mignon was a *rare* encounter. Against the advice of her family and friends, Filet Mignon went to live with the old professor and eventually married him after he divorced his wife. In the beginning Filet Mignon saw herself as a dedicated wife who would assist her husband in his scientific work, which mostly concentrated on studying the effect of the magnetic field on the *medium*.

After a while, however, something happened. Two forces were at work.

Physically and emotionally, she became tired of her old husband. Intellectually, she began to feel the winds of revival that were spreading over Europe in the field of science. In those years, the center of development of quantum mechanical ideas was certainly Germany. The initial development of quantum mechanics is strongly associated with Germany, specifically with Germany after the end of World War I. Somehow the philosophical ideas and some pessimism inherent in quantum mechanics seem to match the atmosphere of ephemeral cynicism of the Weimar Republic. It seems fitting that both quantum mechanics and psychoanalysis are mostly a product of the German culture of the 1920s.

In any case, Filet Mignon became exposed to quantum mechanical ideas from German students who were in exchange programs at the Sorbonne. These encounters opened her mind and other parts of her body. When her husband died, she moved to Berlin and became an assistant to Professor Wiener Schnitzel. In the course of her research she developed a calculational method that is still known today as the FM approximation. It is said that when she presented her results to a learned audience, the comment "*Well done*!" was heard.

Sadly, the same culture that spurred quantum mechanics and psychoanalysis also brought the Nazis to power. After some time, it came to the attention of the authorities that Filet Mignon might have some traces of Jewish blood. She realized that things were going to get worse and, like many other scientists, emigrated to the United States. Eventually, she gave up physics, married again, and opened a vegetarian restaurant in New York City.

OTTAVA GIORNATA (EIGHTH DAY)
STORIES CONNECTED WITH MARRIAGE

The stories narrated during this day are somewhat related to the relationship between husband and wife. All these stories involve an odd couple, that is Professor Gianluca Baragatti and his wife Berenice. Do they also appear in other giornate? Of course they do! Hopefully the stories convey the importance, for a long-term relationship, of a sense of humor and self-deprecation, without which no moral purpose could even be claimed. And of course, just like the other stories, they contribute to the unity of the book by having a connection, direct or indirect, to some aspects of the world of physics.

Declaring marriage status disconcerts the staff at an Italian hotel. Attempting a joke on the wife turns against the husband. Different perceptions of the same event by a man and a woman. Searching for landmines with radiation and dogs leads to exploration of financial investments. These and other stories are narrated during this day.

Croce e Delizia

Professor Gianluca Baragatti and his wife Berenice had gone to the Civic Theater to see Verdi's opera *La Traviata.* A few days later Baragatti was discussing the opera with his friend Massimo Pirelli. As usual, they were trying to find some connection with physics and especially with quantum mechanics. "Most of the characters in operas are bipolar," said Pirelli, "and bipolarity is very important in experimental physics. Heck, without it we would not even have accelerators."

"Agreed." said Gianluca. "I believe that Verdi and the author of Traviata's libretto, Francesco Maria Piave, had some kind of intuition, probably unconsciously, about the principles of quantum mechanics. I am especially thinking of the famous aria when Alfredo sings about his love for Violetta. *Croce e delizia*, or cross and delight. It appears that love is a kind of alternation between two states, the pain of the cross and great pleasure. While we may feel these states appear at different times, the underlying reality may actually be a superposition of these states, just like with the Schrödinger cat."

“So, what determines one state or the other?” asked Pirelli.

“Pure randomness, my dear, and especially with women you never know what comes next: cruci-fiction or marital bliss.”

“I understand, but why do you say cruci-fiction? The correct spelling in English is crucifixion.”

“The first crucifixion was real, a historical fact, but what they attached to it over two thousand years made it a cruci-fiction.”

“Gianluca, Gianluca, you are a *miscredente*, an unbeliever,” said Massimo.

“That is true, I am a *Miss-credente*, I believe in Miss Italia, Miss World, Miss Universe, those kinds of things…”

“You should watch it, you can get into trouble saying things like that, a large part of the population may find what you say highly offensive and sue you or worse.”

The two friends spent the rest of the afternoon talking about less controversial subjects.

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Some days later Professor Baragatti and Berenice were at a huge yard filled with polished slabs of stone, marble, granite, even manmade composites. They had decided to remodel a bathroom in their house, and they needed to select some granite that would be the countertop for the cabinets affected. This was an occasion for Gianluca to learn new words, such as backsplash, of whose meaning he was unsure.

Berenice had brought along some tiles that were going to cover other parts of the bathroom, such as the floor and the shower walls. Berenice would put the tiles next to each slab being considered, and a discussion with the salesman would ensue. The two words most frequently used in this discussion were matching and picking up.

“This granite, which comes from the state of Espirito Santo in Brazil, does a marvelous job of picking up the green and the yellow in your tiles,” the salesman would say.

“Yes, and those are the colors of the Brazilian flag, but it does not pick up the faint shade of brown which is also in the tiles and which matches other artifacts in the bathroom.”

While these discussions were taking place, Gianluca appeared to be somewhat absent minded (a not infrequent state of his, according to Berenice) and was following his own line of thought.

When I was at the University of Milan, he thought, *the term picking up referred almost exclusively to picking up women. That was years before the sexual revolution and the discussions on the subject were mostly fiction. We (a group of nerds studying physics) had also heard of someone picking up some kind of venereal disease, although fortunately none of us had personal experience in that area. We were studying optics too, but we had never heard about picking up colors*.

As soon as the expression "venereal disease" came to his mind, Gianluca started following another train of thought. *Why*, he asked himself, *are they called venereal diseases?* It appears that men are both affected and responsible for these diseases, and Venus is certainly a female symbol. Political correctness would demand that a gender-neutral terminology should be used. Most likely the forces at work in this area had not thought of it yet. He made a mental note to himself to discuss the subject with Massimo Pirelli at their next meeting. Perhaps by reviewing Greek mythology they could come up with a name that would not appear to put the blame on women only.

By this time Berenice had identified a granite slab that could work. "Are you done thinking about science?" she asked, "And what do you think of this?" "I think it is beautiful, and it also picks up some of the infrared and the ultraviolet which are respectively reemitted and reflected by the tiles."

"You clearly do not understand these things," said Berenice.

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Gianluca Baragatti was watching Berenice as she was talking with a salesman in a large commercial center. What was weird about the situation was that Berenice could not see him, and, even though he was far away, that he could perfectly understand every word that the two were saying. Gianluca's hearing was not too good and usually he had problems understanding people even at close distance. What was even weirder was that the articles for sale at the place were crosses, in all sizes, colors, and shapes.

In the last few years, the practice of crucifixion of husbands, and sometimes of significant others, had really taken off and a large business

had developed. Baragatti listened carefully as the salesman was saying: "Do you have a picture of your husband? Our exterior decorators suggest that the cross should pick up the color of the husband's eyes. Also, we have nails in different styles, chrome, brushed nickel, bronze, gold."

"I would like to see your catalogue," said Berenice, "I would prefer a simple but stylish model, without too many electronic gadgets."

"I agree with you ma'am. All our models are manufactured with fine woods, not like those cheap plastic crosses that you can buy on the Internet."

"And how soon can you deliver?" asked Berenice. The salesman said that their standard policy was three weeks from accepting the order, which gave Gianluca a sense of relief, even though Berenice was slightly disappointed, since obviously she had hoped for faster delivery.

"We also have a new product you might be interested in," added the salesman. "It is called the Resurrection line."

"Absolutely not!" said Berenice. "One time is enough."

Professor Baragatti woke up. Since he was an optimist, after regaining consciousness he thought: *That was a nightmare about* croce*. I hope that my next dream will be about* delizia*.*

Hotels and Motels

Professor Gianluca Baragatti and his wife Berenice were flying from the United States to Italy. For Gianluca this was going to be a trip down memory lane, since it would include reconnecting with old friends and university colleagues whom he had not seen for over fifty years. During the flight he reminisced about the days when he was studying physics in Milan. At that time the most famous member of the faculty was Giuseppe Occhialini who had co-discovered the pi meson and had made other important contributions to the field of high energy physics. In 1937, partly because of dissatisfaction with the fascist regime in Italy, Occhialini had gone to Brazil to assist with the creation of the new University of São Paulo. About thirty-five years later, at about the same age, and not necessarily because of dissatisfaction with a political regime, Gianluca had also gone to Brazil, to work at a Physics Department that had been started by his former professor. Musing about having something in common with a

famous scientist, who, according to many, was deserving of a Nobel prize, helped with passing the time during an otherwise uneventful flight.

This chain of thought was interrupted upon landing at the Malpensa airport in Milan. After getting their luggage, Gianluca and Berenice made their way to the rental car agency. Along the way they noticed many signs on the walls with large letters screaming out MAGA MAGA MAGA...

When Baragatti saw the signs, his face dropped. “Oh no,” he thought, “it has arrived here too.” He was thinking, of course, of the “Make America Gross Again” slogan, a grouping of words that unfortunately have been very successful in their aim over the past few years. But, as the couple neared the rental car counter, a bigger sign made it clear that the meaning of the local MAGA acronym was actually “*Museo di Arte di Gallarate*,” the last word being the name of a town close to the airport.

Area near Gallarate and Malpensa Airport

Gianluca and Berenice drove to a town by the name of Bischerate, where they had made a hotel reservation (actually it was Berenice who drove, she usually did). The area of Lombardy that includes the airport is known as Brianza, and many of the names of the towns there end in -ate, like Merate, Solbiate, Cogliate, etc. The names of the towns are pronounced the same as “karate.” Some English-speaking people frequently mispronounce them all the time. We heard of one guy who lost his GPS reception while he was trying to get to Milan’s second airport, Linate. He was asking directions for “*Laineit*”, and he never got there!

As they were driving, the Baragattis noticed the occasional presence of women who were standing by the side of the road. Most of the women appeared to be young and somewhat attractive. “I think that they are waiting for transportation,” said Gianluca, “maybe we could offer one of them a ride.” “Do not even think about it!” said Berenice.

In any event, the Baragattis got to Bischerate, and to their hotel. It was not

far from the *autostrada* and was in a convenient location to stop before resuming traveling South. In Europe, unlike in America, when you check into a hotel, they ask you for your documents. The man at the reception looked first at Gianluca's passport. When he received Berenice's passport, his reaction revealed as much surprise as the face of Professor Baragatti had displayed when confronted by the MAGA signs at the airport.

"Ah," said the receptionist, "siete sposati!" which translates to "Ah, you are married!"

"Is that a problem?" inquired Gianluca. "No, no, no problem, sir," said the receptionist hastily, but he also said something, in a dialect that Gianluca did not know, to a lady at the other end of the hall. She also looked surprised. The hotel was not very large and apparently news travelled fast within it. Soon two housekeepers who had been cleaning upstairs appeared at the top of a railing and stared down at the newcomers. The hotel also had a small restaurant. The news must have travelled to the kitchen, as the cook and his assistant briefly poked their heads out. And a careful observer would have noticed that a young fellow who was standing by the door to greet new arrivals communicated some interesting news to a taxi driver who was sitting in the car outside the hotel.

The receptionist asked if he could temporarily keep the passports in order to record the data, and the guests could pick them up later. Gianluca wondered if, after all the attention, they were going to make copies of the documents, maybe make fancy engravings, and eventually display them on the walls of the reception hall. After Gianluca and Berenice had settled down and recovered from the long flight, they turned on their computers and connected to the internet. Gianluca had noticed that there was a larger hotel close by, so out of curiosity he found its website and checked it out. He was surprised to find out that the hotel had, in addition to the regular rooms, a number of attractive suites. Each had lots of mirrors and was apparently designed according to a different romantic theme. In Brazil, unlike in the US and Europe, an establishment offering accommodations of this type would be known as a motel, but not as a hotel. Two of the suites (which, incidentally, were available for rental by the hour) are illustrated below.

Examples of mirrored suites at hotel/motel near Malpensa Airport

Suddenly, something clicked in Professor Baragatti's head, and he said: "Maybe I am beginning to understand something. This is one of the most prosperous areas of Italy, and there are many small industries. The men that own and run these industries are usually well off, conservative, and outwardly God-fearing, but most of them secretly indulge in sexual peccadillos on the side. I suspect that these hotels, or motels, cater to that clientele. Maybe the guy downstairs thought you were my lover, or *amante*, as they say. When I think about the ladies that we saw along the road while we were driving here, I am afraid that he could have gotten an even worse idea. That would be utterly disgusting, and, if I were not afraid of making things worse, I would complain."

"My dear," said Berenice, "you are probably right about what the staff assumed or did not assume, but do not give me that bull about you being shocked. I know you better than you know yourself. I know you are secretly pleased with this little happening. In fact, it would not surprise me if later you even dress it up and write one of your silly stories about it."

Of Grappa and Mouthwash

All towns in Italy have their own historical and cultural traditions. Trento, a city in the northern Alps region, is remembered for the Council which took place there from 1543 to 1545 and signified the response of the Catholic Church to the protestant reform of Martin Luther. Hundreds, maybe thousands of cardinals, archbishops, theologians, preachers, and other religious lobbyists descended on the town and left a distinctive smell that can still be found in the old churches. Professor Gianluca Baragatti, who had a connection to the town because of family history, did not particularly

care for that smell, instead preferring the aroma of a fine distillate that is produced in the area.

Opening of the Council of Trento

Grappa is a strong alcoholic drink which is made by distilling a blend of grape seeds, stalks, and other residues left over from the wine-making process. It has a strong, distinctive smell. In his mind Professor Baragatti associated both religion and grappa with the city of Trento. On the few occasions when he was able to get back there, he always made it a point to bring back some of the latter.

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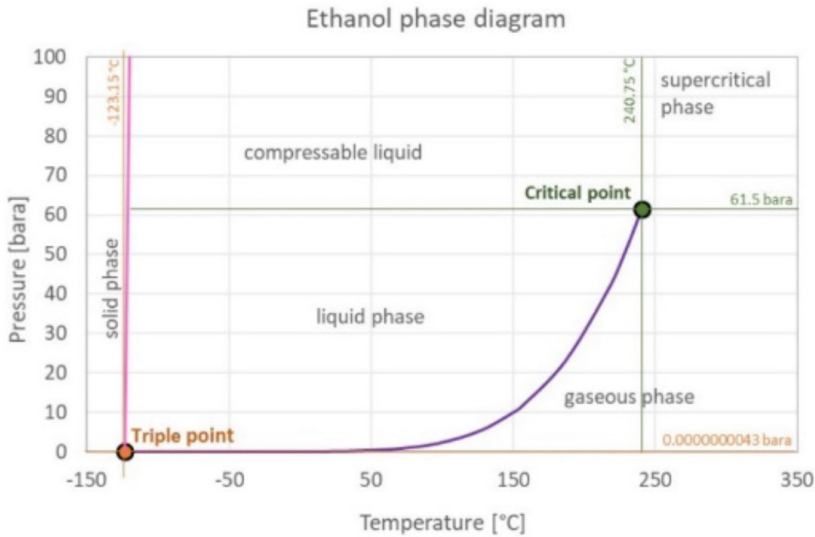
Professor Gianluca Baragatti and his wife Berenice were at the Los Angeles airport, returning from a trip to Europe. They had been traveling in Italy, where they had visited a number of towns, including Trento. As they approached the carousel where the suitcases from their flight were being unloaded, Berenice was the first to detect a whiff of something. “It smells like grappa,” she said. “Impossible, we are in California,” replied Gianluca. But as they got closer and closer, the smell could not be missed. Gianluca immediately realized what had happened. He had bought an undisclosed amount of grappa in Trento. The bottles had been put in one of their suitcases, but they must have leaked somewhat and the alcohol was now making its presence clearly known.

“@#%$&! and more #@&*!” said Professor Baragatti. To put it mildly, the statement, which was longer than it appears here, was a mixture of blasphemous, profane, and sexual connotations directed at the highest hierarchy of divine entities.

“You should wash your mouth out, there are children around,” said Berenice. She had learned that expression through her accounting work at a local elementary school, having listened to teachers disciplining young kids who were using bad words. After the suitcase was recovered and brought home, the autopsy of it revealed that about one third of the grappa was gone, and the surrounding clothing had gladly absorbed the content. The clothes had to be sent to rehab and it took several days of airing them out in the open for them to be fully detoxified. Since the seal on the bottle had originally appeared to be quite good, Professor Baragatti struggled to find a scientific explanation for what had happened. “Perhaps,” he mused, “the cargo compartment where they put the luggage in the airplane is not pressurized, and the lower pressure makes the alcohol more volatile and more inclined to get out.” He even looked at the phase diagram for ethanol, but he quickly convinced himself that this could not be a relevant factor.



No, the seal on the bottle must have been somewhat defective and, since that most unfortunate incident, Professor Baragatti has introduced a policy of generously taping the neck of any alcohol containing bottle to be placed into a suitcase for air travel. To our knowledge no more incidents of that nature have occurred.

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Brazil is a land of immigrants, and immigrants carry many aspects of their culture into their new country. One cultural element involves names, and is illustrated in Brazil by the number of towns with names that are directly related to a town in the country of origin. For example, the Germans founded Nova Friburgo in Rio de Janeiro and Novo Hamburgo in Rio Grande do Sul, a state in which we also find Nova Bassano, Nova Brescia, and Nova Padua. In Espirito Santo there is a Nova Roma and a Nova Venécia. Two more new Venices, with the spelling Nova Veneza, can be found in Goias and Santa Catarina, a state that also includes the municipality of Nova Trento.

Several years after the grappa incident narrated above, Gianluca Baragatti and Berenice were travelling in Brazil. They rented a car in Florianopolis, capital of the state of Santa Catarina, and along with other places they made a stop in Nova Trento. Gianluca was amazed at how closely the local culture mirrored that of the old world. The central piece at a buffet restaurant was a gigantic polenta, and items on the menu used terms that would be hardly recognizable outside the Trento region, even within Italy. Gianluca asked a lady whether she could speak Italian, and her answer was "*un pochettin*," which is an unmistakable colloquial form from the Trento area dialect meaning "a little bit."

Professor Baragatti quickly realized that religion plays a big part in Nova Trento, which is a frequent destination of pilgrimages. This is all due to one very determined woman, who was born in 1865 in Vigolo Vattaro, a village about ten miles south of Trento, which at that time was part of the Austro-Hungarian empire. Her family emigrated to Brazil where she became a nun, and eventually she founded a religious order within which she was initially named Superior General. However, as the order grew in membership and finances, she was replaced with someone more inclined to politics and she spent the rest of her life doing good things for the poor. She was initially known as Madre Paulina, but in 2002 she was declared a saint by Pope John Paul II. Henceforth, she has been known as Santa Paulina, the first Brazilian female saint, with her own sanctuary in Nova Trento. The sanctuary even has their own *reliquiae*; three relics were made from the fingerbones of her hand: of these, one should be in the Vatican, one is in Nova Trento, and one is in Pennsylvania.

Gianluca Baragatti was understandably happy to find out that the other characteristic feature of Trento (from his binary worldview, that is) was

also present in Nova Trento. Yes, they were making grappa there.

Entrance to Nova Trento, Brazil

Now, this grappa was not like the ones that you buy in stores, which are bottled nicely with labels that tell poetic stories about the origin, declare the alcohol content, and so on. This was home-made grappa, with a strong flavor, in unlabeled wine bottles with corks pushed down by hand. Gianluca bought an undisclosed amount, over the remonstrations of Berenice. “What are you going to do with all this grappa? You obviously are not going to drink it all, and you are certainly not going to take it home!” “I will figure it out, and it is cheap anyway.”

During the rest of the trip Professor Baragatti drank some of the grappa after meals (moderately, as the stuff was strong), and he also used it to rinse his mouth mornings and evenings. It was better than Listerine.

In this manner, the grappa was used up before the end of the trip and there was no need for air transportation. Thankfully, the risk of accidental leakage and consequential offensive outbursts was eliminated. Most likely Professor Baragatti would not be told to wash his mouth out, since, thanks to the grappa, he had already washed his mouth in.

A Failed Quantum Transition

When he was still a relatively young man, Professor Gianluca Baragatti (he was not even a professor then) had invited some friends over for dinner. He and his wife Berenice had prepared a mixture of Italian-Brazilian food and were now enjoying an evening of pleasant conversation with their friends,

who seemed to appreciate the wine and everything else. At some point before the dinner Gianluca had come up with an idea that he thought would bring some laughs. You have to know that the dinner was taking place in California and that each one of the participants was dressed in a very extreme informal way. You also must know that Baragatti owned a formal tuxedo, which he had bought a few years earlier for some kind of social function and almost never used again.

Shortly before the guests arrived, and while Berenice was busy in the kitchen, Gianluca went upstairs to the master bedroom and carefully arranged the tuxedo and all the accessories on the bed, ordered so that they could be put on very quickly. Then, at some point during the dinner, he asked to be excused and went upstairs, apparently for a sudden need to go to the bathroom. As he was climbing the stairs he started to unzip his pants and then worked furiously to put on the tuxedo. After exactly one minute and twenty-seven seconds since he had left the table, he was descending the stairs dressed as for a ball at the Imperial Palace in Vienna (well almost).

Everybody was surprised and amused at the appearance, also because, with the intense conversation going on, the time of the transition seemed even less. “I did not know that we were having dinner with Houdini,” commented one guest. Berenice shook her head and said, “I still do not know how my husband’s mind works.” “That was so fast that it was almost like a quantum transition,” said another guest.

The evening ended pleasantly and everybody left in good spirits.

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A few years afterwards, Professor Baragatti, Berenice, and their two daughters were spending some vacation time in France. It was a very hot summer and they had been driving all day in a rented car towards the South of France. They had left Paris early in the morning, stopped briefly to look at castles on the way, occasionally lost the way, argued about where and what to eat, and were understandably sweaty and tired. In addition, they had not made a hotel reservation, and when they tried to do so at lodgings encountered at the destination, they found out that everything within a big radius was booked.

A combination of French patriotic, scientific and literary conventions coupled with a religious holiday of some kind was taking place, which resulted in many more kilometers to be driven and additional stress being added. Finally, thanks to a tip, a suitable accommodation was found in a

decent hotel in a medieval town.

When they were starting to register at the desk, Gianluca had a strong need to go pee (he usually did) and his family graciously told him, “Grab the key and go upstairs, we will finish the registration, show the passports, unload the luggage, and then join you.” Gianluca thought that was nice and rushed to the elevator with a small bag that contained a clean change of clothes. The room was maybe on the third floor (the hotel was not small) and, as Gianluca finished his urgent business, the quantum tuxedo transition came to his mind and he had a sudden idea. Why not take a very quick shower and change, so that when his family appeared, he would look fresh as a rose, not sweaty and covered with dust like them? So, he jumped in the shower and tried to make himself look as spiffy as possible. Well, it did not work out.

The registration process did not take as long as expected, so Berenice and the children arrived while Gianluca was still in the shower. Since he had the key, he had left the door slightly open, but his family, hearing the water running, thought that perhaps they had got the room number wrong, and did not want to enter and find a naked French man or worse. So, they dragged the luggage all over the other floors, looking for the right room, and maybe even went back to the desk to check on the number. When they finally arrived, they were furious and jointly accused the head of the family (so to speak) of just caring about himself and not giving a damn about them. “It was intended to be a joke, like a parody of a quantum transition…” said Baragatti, meekly. “We are tired of your jokes and your quantum transitions, you just do not care… blah... blah... blah.”

That night the family ate something at the hotel restaurant but the atmosphere was icy and Professor Baragatti was in the doghouse. Things were better in the following days.

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Several years later Gianluca and Berenice were still together. By this time, she still had not figured out how her husband’s mind worked and at times was shaking her head. All considered they had a good relationship, but like with all old couples there were occasional moments of tension. On one such occasion, Berenice said, “You only care about yourself, you do not care about other people. Just like that time in the South of France, when instead of helping us with the luggage you just went and took a shower. Even our daughters are still traumatized by that event…”

Professor Baragatti never tried to impersonate a quantum transition again.

Bitcoins

Professor Gianluca Baragatti was attending a meeting of the International Canine Association at a large resort in Florida. His wife Berenice had accompanied him, so that after the meeting they could take a few days of relaxation. He was attending this meeting because, as part of a larger government contract, he had overseen a series of tests on the detection of landmines. The tests were intended to compare the performance of some specialized detection equipment - developed by his company and involving the use of nuclear radiation - with the performance of specially trained dogs, who were using their nose. That is why Gianluca was now presenting a paper on the test results, which indicated that the dogs were much more successful in detecting landmines than the radiation device. The audience, not being technically inclined, did not care much about the scientific details, but was very happy hearing that the dogs came out on top.

After giving his paper, Gianluca rejoined Berenice who was relaxing in one of the gardens adjacent to the hotel. “I am all done with this place,” he said, “and I have no intention to listen to anymore papers dealing with dog grooming and the like. By the way, this place is enormous, and I believe that on the other side they have another conference running, something that has to do with laundering, I think. Since you always insist on washing clothes much more than necessary, perhaps this would be of interest to you…”

“I have seen the event listing, and that conference is not about laundering, it is about money laundering!” said Berenice. “And when it comes to washing, if it were not for me, you would still be wearing the shirt that you wore when we got married.”

“That was a nice shirt…”

“As a matter of fact,” added Berenice, “While I was relaxing in the garden, I met a fellow who is attending that conference. His name is Gus, he is Asian, and he is a very pleasant man. I told him about your interests and he would like to meet you. He also seems to be very knowledgeable about Asian food and knows a very good Chinese restaurant nearby. If you want, we can join him later for lunch.”

“Excellent idea,” said Gianluca, “The only thing the people here are talking about is dogs, dogs, dogs… Money and finances may well be a better conversation subject than dogs, maybe even better than physics.”

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Gianluca Baragatti and Berenice met Gus and went together for lunch at the Golden Dragon, a slightly upscale Chinese restaurant that, unlike Americanized versions, did not give out fortune cookies. The food was very good, but Gianluca steadfastly refused to use the chopsticks and asked for a fork. The conversation mostly centered on comparing Italian and Chinese cooking, however money subjects occasionally crept in, and Gianluca was impressed with the deep knowledge of the financial markets that Gus possessed. So much so that he planned to ask him for some advice. After lunch was over, Berenice went back to the room to rest, while Gianluca and Gus continued the conversation.

*****

After a couple of hours Gianluca rejoined Berenice. He was very excited. “This fellow Gus is really amazing. He knows a lot about investments and has made me aware of a fantastic opportunity for increasing our assets in this digital new world. It is called BITCOINS.”

“I heard about it…” said Berenice.

“You always know more than I do in these matters,” said Gianluca, “but what really impressed me were the examples he gave me, with graphs, and so on. And he knows a lot about foreign currencies. He showed me that if I had put in say 1,000 Brazilian cruzeiros, cruzados, reais… say three years ago, I would now have a fantastic amount in bitcoins. And it looked even better when he used Argentinian pesos and Venezuelans bolivars… I would not do anything unless you agree to it, but I think we should consider converting part, if not all, of my retirement account to bitcoins…”

“Did he give you an example using the Greek currency too?” inquired Berenice. “We should really talk.”

*****

Professor Gianluca Baragatti and his wife Berenice talked it over. She explained to him all about inflation and easily convinced him not to invest their money into bitcoins. That is why as of today they still have money to

enjoy a comfortable retirement. As for Gus, we believe that he is currently attending another financial conference.

Looking Back and Getting Scared

Professor Gianluca Baragatti was relaxing after lunch. As usual he had an espresso, looked at the newspaper, attempted to solve a puzzle only to get mixed results, and then fell into a sort of meditation. *Looking back in time,* he thought. *We do that all the time, especially when we regret something we have done. According to the theory of relativity, past, present, and future can sometimes get mixed up (depending on reference systems, and so on). Does that mean that, under appropriate conditions, we could look back into the future?*

In the old days he understood this kind of thing, but now it was a bit nebulous, especially after drinking some grappa. *What about looking back in space? To do that, we usually turn our head. But wait - when I get in our car, I can look back using the camera, and I see what is behind.* As his wife Berenice used to say, Baragatti's mind was working in strange ways. As soon as he thought of the camera in the car, an idea came to his mind. He would play a little joke on his wife, who would be mildly scared at first, and then all would end with a laugh. Or so he thought.

Since he was a man of action, Gianluca set to work immediately. First, he went on the internet and found a picture of a terribly scary monster. Then he blew up the picture and printed it on a rather large piece of paper, which required some work. After attaching the picture to a piece of rigid cardboard he went to the garage and started experimenting. He could do that at ease because Berenice had gone on a long shopping expedition and had taken the other car. After bending some wire coat hangers, he attached them to the screws holding the license plate in the back of the car. The bent coat hangers were somehow supporting the picture of the monster and, after some experimentation, he found the right position. Now, when the car was in reverse gear, the small screen on the dashboard showed the picture of the scary monster instead of the area behind the car.

The professor knew that the following morning Berenice would take the car out of the garage to go help Mrs. Bruckner, an old lady who had moved into an assisted living type of residence. *As soon as she backs out of the garage*, he thought, *she will see the picture and get a bit scared, but I will*

be there and make sure that she does not drive away with that contraption attached. Otherwise, she would be very angry at me.

*****

The following morning Berenice got in the car, put the gear in reverse and drove away so quickly that Gianluca, in spite of his frantic efforts to stop her, could not get her attention.

Oh my God, he thought, *now she will be really mad at me. I had better start thinking of something positive to distract myself.* And he started looking at his books trying to find a subject to concentrate on.

Half an hour later the phone rang. It was Berenice. “Dear,” she said, “you know that we have a party coming up. So, I have decided to have my hair done, I want to look decent, and it will take a bit longer before I get home.”

“Take your time,” said Gianluca, “you always look great and it makes me happy when you take care of yourself.”

“By the way,” said Berenice, “I lent the car to Mrs. Bruckner, so she can pick up some of the things she likes at the deli while I am having my hair done.”

“You did what?! She is ninety-one! And I did not think she even knew how to drive! And what about the car?”

“Oh, she can drive much better than you do, she always uses the signals before turning… And the car is going fine, no problems. See you later.” And she closed the communication.

*****

Half an hour later Gianluca was still trying to find a subject to concentrate on when the phone rang again.

“This is Captain Stevens of the Highway Patrol. Are you the owner of a dark SUV with license so and so? I am afraid I have bad news for you. An old lady was driving your car. She put it in reverse and apparently something scared her. The car went directly into the deli. It is a huge mess, and I suggest that you come over here quickly.”

Gianluca was white with fear. He could barely manage to get the information from the officer and ran to the other family car.

*****

When Gianluca arrived at the deli he found Berenice and Mrs. Bruckner sitting outside having coffee and pastries. They laughed at him.

“Did you think you were going to scare me dear? That should teach you a lesson next time you think of coming up with this type of joke.”

“I get it,” said Gianluca sheepishly, “and you even managed to have your hair done. But who in the world was that Captain Stevens?”

“I will explain that later,” said Berenice. “We women have tricks.”

Fake News via Cutting and Pasting

Professor Gianluca Baragatti enjoyed playing tricks on friends and family. Although he had an unquestionably weird sense of humor, his jokes never exceeded what he considered a sense of fairness and were never intended to hurt anyone. Now in his old age and recovering from a not too serious operation, he liked to say that he was living in a nursing home, where he was allowed to cook, and where he was taken care of by two “adorable creatures,” who were actually his wife Berenice and his daughter Vanessa. One day Mrs. Baragatti found a letter in the mailbox. The envelope was properly stamped and looked as if it had been processed by the post office. The letter appeared to have been sent from North Carolina, and was full of Shakespearean references. In it, two sisters relayed that they had heard great things about the nursing home operated by Berenice and were hoping that their father, Lear King, could also become a resident of said nursing home. It did not take much time for Berenice to figure out that the letter was a forgery and that the perpetrator was - guess who? - her dear husband.

A few laughs followed.

Some time had gone by since that episode, and Professor Baragatti was itching to come up with another innocent joke. He finally got an idea while reading the San Diego Union Tribune, his regular Sunday morning newspaper. After reading the cartoons and doing some crossword puzzles, he usually turned to the part of the local section titled Life Tributes and looked at the obituaries. By quickly scanning the pages, and looking at the birthdates of the departed, Gianluca could build a kind of mental histogram and get a sense of the average length of life for the sample of people listed in the newspaper.

Since this average life span, in general, tended to be lower than his current age, Professor Baragatti felt a sensation that could perhaps be defined as *schadenfreude*, a word that he had learned from a New York Times article. Schadenfreude apparently refers to the experience of self-satisfaction that comes from recognizing that other people are worse off than you are.

Once he got his idea Gianluca set off to work. First, he had to figure out the print font and size used in the newspaper, which was fairly easy. But the available blank paper to print on was a problem, because its color and reflectivity did not match the paper used by the Union Tribune. Luckily, Bank of America came to the rescue, since they had a huge one-page advertisement that had their logo in the center of the page and that left enough blank space on the sides for the intended purpose. Gianluca cut a section out of this blank area, taped it to a regular sheet, and printed a prepared blurb on it. Then, he carefully cut out an obituary, and replaced it with his new one, carefully taping it onto the back of the page.

Now, you may think that this is simple. But you must keep in mind that, in order to maintain the surprise, this had to be done in strict secrecy. And it is very difficult to keep things from Berenice, who can see everything, hear everything, and smell everything. And, let us not forget her acute sixth sense, which made her suspicious that her husband was in fact up to something. In addition, this was taking place during a period of restrictions imposed during a pandemic, so most of the time Gianluca was not alone in the house. However, by taking advantage of the time when Berenice was out of the house shopping for groceries, he was able to complete his project. He was concerned that the cut and paste job would be recognized immediately because, even though he had taken great care, a careful eye could spot the fine lines along the seams. Still, the following Sunday Gianluca picked up the newspaper and inserted the pages on which he had

performed his careful "surgery" (let us call it that). Then, at a convenient time in the morning, he grew very excited and called his wife to come over and see the news in the paper.

The San Diego Union-Tribune
Everlasting memories of loved ones
Gianluca Baragatti
September 29, 1938 – November 3, 2020
San Diego –
Gianluca Baragatti died on November 3, 2020. He had a heart attack the night of the election, when it appeared that the incumbent president was close to a win.
Gianluca was born and grew up in Rome, Italy, the cradle of civilization, and once the seat of the Holy Roman Empire. He had a degree in Physics
and always went to their children's school and extra-curricular activities. Family outings to the beach, zoo, ice-cream store and restaurants were guided by Ronni's love but a firm commitment for her children to be polite. Ronni had a very quick wit and would have giggle fits with her children and grandchildren that are definitely treasured memories. After her
specialist on anything, but he never hesitated to get involved in things of which he knew nothing about.
His most important professional accomplishment was the discovery of a new element, the Berenicium, for which he was awarded a Nobel prize in Physics, although this was never disclosed, for national security

The Union Tribune after "surgery"

The section that was cut and pasted is reproduced on the next page. It did not take very long for Berenice to figure out who had done it. However, to Gianluca's surprise, she did not immediately notice the cut and paste job; instead, she questioned whether her husband had paid for the insertion of such a crazy obituary.

Professor Baragatti had fun watching his wife while she was reading the mostly fake news and commenting on the components. "Active in sports ... hah ... member of churches ... hah ... meditation ... hah ... eating habits ... hah ...no alcohol ...hah! The only true thing in this '*obituary*' is the part about watching while I am gardening."

At the end Berenice had a good laugh too. Gianluca was happy that he had managed to pull off the surprise and that he had done a good job with the cutting and pasting, a real cut and paste, for a change, not one done on a computer.

Gianluca Baragatti

September 29, 1938 – November 3, 2020

San Diego –
Gianluca Baragatti died on November 3, 2020. He had a heart attack the night of the election, when it appeared that the incumbent president was close to a win.
Gianluca was born and grew up in Rome, Italy, the cradle of civilization, and once the seat of the Holy Roman Empire. He had a degree in Physics from the University of Milan.
After working a few years at an international European Center, being dissatisfied with the decadence of family values in Italian society, he moved to the United States, where he worked in the private sector, mostly on producing and analyzing irreproducible results that were commissioned by the US Government.
He then spent a year and a half in Brazil, in university settings, while immersing himself in several aspects of Brazilian culture. In Brazil he met Berenice, the love of his life. Their marriage of 48 years was a paragon of joy and partnership. Together they welcomed everyone in their circle to an open home for Sunday dinners and weekends.
Back in the United States, after spending a few years working on a nuclear reactor concept that was eventually abandoned, he joined a private venture devoted to the commercialization of science. In this endeavor, Gianluca never became a specialist in anything, but he never hesitated to get involved in things about which he knew absolutely nothing.
His most important professional accomplishment was the discovery of a new element, the Berenicium, for which he was awarded a Nobel prize in Physics, although this was never disclosed, for national security purposes.
Gianluca was active in sports, such as swimming, running, and bicycling, and also in community activities, and was a ghost member of many churches and religious organizations. He practiced yoga and meditation, and spent many hours reading oriental sacred books.
He enjoyed hobbies, travel, and loved watching his wife's gardening. He was very careful with his eating habits and never touched any alcohol.
He is survived by his wife Berenice, his daughters Belinda and Vanessa, and many grandchildren. In lieu of flowers, please make contributions to the Self Appreciation Brotherhood, created by a great Indian guru, Jokerellanda Parakulanda.
Gianluca's passing left a hole in the hearts of those who knew him. Let's all do our best to follow in the path of a true gentleman, father, son, brother, friend and colleague and leave the world a better place for each other.

Other people also read the piece and did not notice the "surgery" until they were told. We believe that there are several reasons why they seemed to be missing this fairly obvious feature. First, people still trust printed newspapers more than whatever appears on their screens, large or small. So, they might have been less inclined to question it. Second, when people concentrate on reading the text, they do not seem to see the fine lines that mark the seams around it.

Third and perhaps most importantly, when it comes to fine lines there is always one that separates fiction from reality. Unfortunately, over recent years our ability to distinguish this fine line seems to have been considerably diminished.

Professor Baragatti had just wanted to experiment with creating fake news with a physical, rather than virtual, method. But the biggest fake news of this tale is that he himself is a fictional character and as such, cannot die. He sincerely apologizes to the nice lady who died at 102 years of age, and whose well-deserved life tribute he replaced with a fake one. And at this time, he is especially thankful that all the Baragatti family members are alive and well.

Perceptions

It should not come as a surprise that different people, faced with the same event, have different perceptions. While this is a positive thing, because it introduces diversity in an otherwise boring life, it may occasionally generate conflicts.

It was the day before Easter, in the middle of the afternoon. Professor Gianluca Baragatti and his wife Berenice were walking along the Coast Highway which runs along the Pacific Ocean in a Southern California town. "You cannot spend all your time sitting at the computer, that is why your back hurts. You need to walk," Berenice had told Gianluca.

On the sea side of the highway there were both a bicycle lane and a comfortable pedestrian-only path used by walkers, joggers, mothers with strollers, dogs on a leash, and occasional bicyclists not respecting the rules. The side of the path opposite to the road quickly ended at the top of bluffs steeply descending to the beach and the ocean. There were signs telling people to stay out, but that did not discourage many adventurous souls who

wanted to go a few feet forward to get a picture standing on the edge of a cliff.

Gianluca and Berenice were walking south on the path when they came close to a couple that had just got out of a parked car. The woman was blindfolded and the man was gently guiding her, stepping over the short path delimiter and moving toward the end of the bluff. After passing the couple, Berenice said: "How romantic! I see a wedding in the making, he is going to propose to her."

"How do you know that?" asked Gianluca. "Women can feel that. And besides, I noticed that he took a little box out of his pocket." As usual, Berenice noticed everything that was going on around her. Gianluca was silent for a while, since his reflexes were slower, but then he observed: "I just hope that he does not throw her over the cliff."

Berenice got suddenly angry at that statement. "You are not romantic at all! You always make jokes that are designed to hurt people's feelings. Even people in your family have said that. And those silly stories that you write, which supposedly have a connection to quantum mechanics, always intend to make fun of your wife and people around you. And the worst part is that you do not recognize that… I do not want to hear about your sense of humor!"

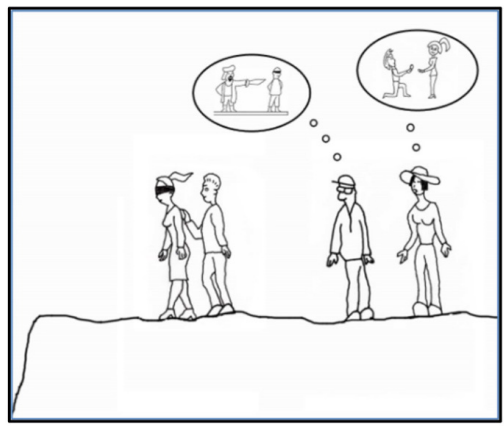
Berenice started walking fast, at a speed that her husband could not adjust to, and quickly disappeared in the distance.

Gianluca was left dumbfounded. *What did I say that was so terrible?* he thought, and continued to walk south at his own pace. *Maybe Berenice is right about a marriage proposal, although I get to that conclusion from a different viewpoint. I may not sense the romantic atmosphere, but I can certainly see the correlation between marriage and walking blindfolded towards an abyss… And in many cases marriage has some features that make it look like a quantum event…*

When Berenice came back the two walked quietly to the car. Along the way, they saw the couple again. They were still at the cliff's edge, unconcerned about the peril, and looking very much in love. Berenice gave Gianluca a significant look, meaning both *I was right* and *You are in the dog house*.

At home, Gianluca found some images and combined them with a little drawing he made. The combined image was supposed to represent the

different perceptions originated by the encounter. At the proper time he showed the drawing to Berenice, hoping that it would be found funny and would get him out of the dog house. He was very surprised when his wife said: "You should write a story about it…"



The Revenge of the Branzino

It was about noon on a quiet Wednesday in April during what, according to some people, is the Holy Week. Professor Gianluca Baragatti was cooking some tortellini while waiting for his wife to come home from some grocery shopping. Berenice arrived in a very happy mood, because she had found a great deal at the local supermarket. She had bought two large branzino fish, with a total weight of about 3 pounds, for the ridiculous sum of $12.50. I say ridiculous because usually branzino, being an aristocratic fish, goes for at least 16 dollars/pound, or more.

Not surprisingly, the couple decided to eat one branzino right away for dinner. The fish went on a hot cast iron grill plate and looked delicious, deskinned and deboned (maybe), with an accompaniment of tiny potatoes. At about 8 p.m. Berenice took a first bite and immediately choked. She had accidentally swallowed a fishbone, which had lodged in her throat. She tried unsuccessfully to remove it, and after a while Professor Baragatti convinced her to be taken to the emergency room at the closest hospital. You should know that the women in Professor Baragatti's household insist that he should not drive, based upon the rationale that he is too old and too absent minded. By the end of this story, he will have driven about 150 miles, some of which was at night.

Be that as it may, Gianluca drove Berenice to the emergency room, where a CT scan revealed the presence of a foreign object, about one inch in length, stuck deep down her throat. For several reasons the staff at the local hospital, which is quite large and modern, would not attempt to extract the bone and referred her to the healthcare facility of the University of California (UCSD).

Final arrangements were made and by about 4 a.m. it was clear that Berenice would be transported by ambulance to UCSD. At this point Professor Baragatti went home, where he ate his abandoned portion of the branzino and managed to get a couple of hours of sleep.

At about 8:30 a.m. Gianluca reconnected with Berenice at UCSD. It is an enormous complex and it took him a while to find her. Interestingly, upon hearing the story, most of the medical staff (at both hospitals) inquired about the kind of fish involved, and with the exception of the surgeon, they did not appear to know what a branzino is. Professor Baragatti was happy to enlighten them, explaining that it is a European sea bass, which sounds kind of elitist.

At about 11 a.m. Berenice was wheeled away to undergo the extraction procedure, which required anesthesia. At this point there was nothing else for Gianluca to do, other than wait, so he went down to the cafeteria, located inside the hospital, to have lunch. To his surprise the menu included pasta carbonara, one of his favorites. However, when he received the dish, he was surprised again. It was a vegan carbonara(!), no pancetta or egg or cream or even bacon, just broccoli and other greenish stuff. And the cafeteria did not have any wine.

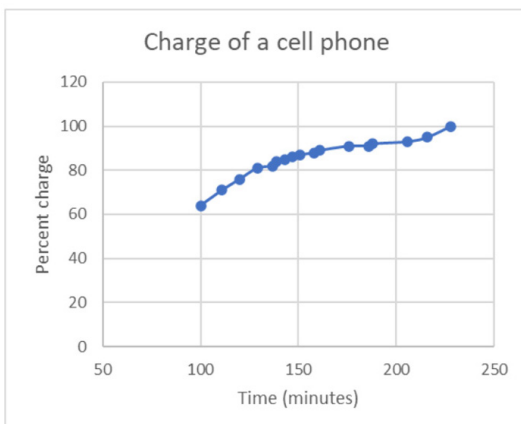
After eating a small amount of the “carbonara” Professor Baragatti walked back to the parking structure to check whether he had gotten a ticket. When he had arrived that morning, in his rush to see Berenice, he had not bothered to sign in or do whatever modern parking lots require. Everything was OK, so he started walking back to the hospital, and at some point, he sat on a bench to rest.

A nice-looking young woman, most likely an employee of the health center, passed by. Not having slept much, Gianluca must have looked despondent and a total mess, because the woman turned back and inquired if he was OK. This gave Gianluca the opportunity to explain why he was there, and so on, and so on. Like everyone else she inquired about the kind of fish, and, guess what, she had never heard of branzino. Professor

Baragatti enlightened her too and also described his disappointment about the "carbonara" and the absence of wine. "What a weirdo," she probably thought.

Walking back to the main building, Professor Baragatti mused that maybe he had found a new way to get the attention of women. Years earlier he had noticed a similar effect while sitting on a bench with a dog to his side. Back in the room at the hospital he waited for Berenice. When she was finally wheeled back in, it was clear that the procedure had been a success; a fishbone about 1.5 inches in length had been extracted, and there had been no need for surgical cuts. At this point it was not clear whether she would be discharged or kept in the hospital for the night.

While waiting for the decision, with Berenice sleeping and her phone being charged, Professor Baragatti made a discovery. In spite of his hostility to cellular phones (and to phones in general) he had always thought that these instruments were used only for important communications. Well, to his astonishment, he realized that they can also be used for entertainment. He realized this because, while waiting, he entertained himself by periodically checking the percent charge of Berenice's cell phone versus time, with the result shown in this figure.



The obtained curve looks suspicious. While the phone is charging, silly messages come in, awakening the phone, displaying something, even making some sounds. This may take some electrons away from the charging function. And the same happens when the observer (Professor Baragatti) decides to record his data point. So, the observer affects the outcome of the experiment, a concept that the lunatics who deal with quantum mechanics have taken to a ridiculously low level, something

called the uncertainty principle.

Around 5 p.m. on Thursday the doctors decided that it was safer for Berenice to spend the night at the hospital. Gianluca was relieved. Had she been discharged, she would have insisted on cleaning the mess from the night before. Instead, Gianluca went home, cleaned the mess, then cooked the second branzino and went to bed.

The following morning (Holy Friday, so they say), Professor Baragatti drove back to UCSD. This time, he left the car in a different parking structure that was closer to the building where Berenice was staying. Around 11 a.m. a woman came into the room, said that Berenice could go home, and provided some dietary instructions. When it came to the story of the fishbone, instead of inquiring about the kind of fish, she casually asked: "Was it a branzino?" This made Professor Baragatti think that some kind of chain reaction had taken place, and awareness of the word "branzino" had propagated through the medical personnel at the hospital.

The final drama in this story came when Professor Baragatti and Berenice walked to the parking structure. Gianluca had somehow forgotten where he had left the car and it took some walking around to find it. Mrs. Baragatti was not happy about it, and she made that abundantly clear. This was good, because it meant that things were back to normal in the Baragatti household. So much so that two days later (Easter Sunday) Gianluca and Berenice were able to prepare a crown of lamb and share it with family and friends.

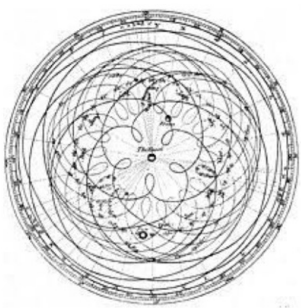
Medical healthcare in the United States is a bit strange. It can be exceptionally good, as it was in this case, as long as you can pay for it.

Luckily, the Baragattis have good insurance, which will cover most of the costs. But one can imagine the branzino savoring the sweet taste of revenge and telling itself: “You thought that I was cheap? Ha! Think again.”

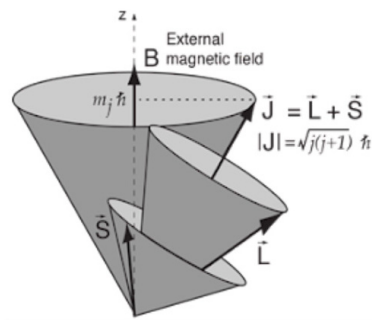
Band-Aids in Physics and Life

According to the dictionary, “BAND-AID” is a trademark used for a small adhesive strip with a gauze pad for covering minor wounds. Additionally, according to the dictionary (again), “band-aid” (lower case) is a noun or adjective used informally to mean a makeshift, limited, or temporary aid or solution that does not satisfy the basic or long-range need.

One can argue that band-aids have been applied multiple times in physics. Every time a theory does not fully explain phenomena and little artifices are introduced to obtain agreement with the experimental data, we could call that process a band-aid application.



Planetary orbits based on epicycles



Vector model of the atom

We can point to two examples of this.

The first example is the Ptolemaic system with its epicycles and deferents. Placing the Earth, instead of the Sun, in the center and insisting on using circles makes it difficult to explain the motion of the planets. Ptolemy and the astronomers of his time introduced small circles (epicycles) that were rotating along larger circles (deferents). Even Copernicus, who placed the Earth in the center, had to maintain epicycles, because of the assumption of perfect circular orbits. Probably, up to eighty or more circles were needed to approximate the motion of the planets, until Kepler introduced ellipses, Newton introduced gravitation, and the results followed from a more

general and elegant theory.

The second example is the old quantum theory, when scientists tried to explain the optical spectra of atoms with many electrons by introducing strange rules for combining vectors representing quantized angular momenta. With the invention (or discovery) of quantum mechanics the results also followed from a more elegant and general theory.

We should not go as far as to view everything as a band-aid. Approximation methods, numerical solutions of differential equations that we cannot integrate exactly, finite element computer programs, and the like cannot properly be considered band-aids.

However, when it comes to life, we can afford a broader view. We could say that a band-aid is whatever helps us in facing an adversity, or a difficult situation. Recently, we heard of a guy who had been dating the same girl for five years and always kept her picture in his wallet. Whenever he faced some difficulties about his life, he would take her picture out and stare at it, which brought him some sort of comfort. That was his band-aid, but what was his reasoning? Knowing that if he could survive a relationship with that psychopath he could survive anything...

While Professor Gianluca Baragatti would not go that far, throughout his life he had been a user and abuser of "band-aids." When something broke down, if it were at all possible, he would figure out a way to keep the thing running, even at the cost of losing some functionality. Needless to say, his wife Berenice was not too keen on his approaches, preferring long-term solutions.

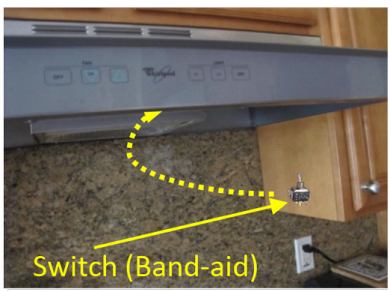
Similar to physics, we can point out two recent examples of band aids in practice.

The first example involves the hood that is located over the stove in the Baragatti family kitchen. The hood contains a fan and a light that are controlled by a touch panel in the front. Well, the touch panel gave up completely, so that the fan and the light would not work anymore. In this instance Baragatti's band-aid consisted of mounting two tiny switches, invisible from the outside, that bypassed the touch panel. These independently turned on the light and the fan, thus allowing the smell to be removed from Professor Baragatti's ethnic cooking.

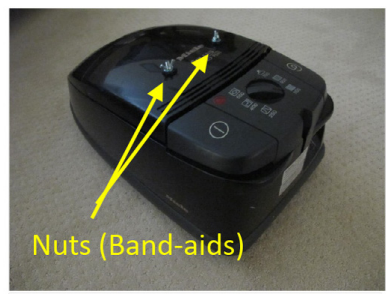
The second example involves a vacuum cleaner with a cover that would not stay latched after the breakage of a small plastic part. The top would spring

open and then the motor would shut off. The band-aid was provided by adding two short bolts with wing nuts. These kept the thing running, even though, admittedly, the result was neither pretty nor elegant.

The band-aids described above, including those in physics, pale in comparison to those necessary to maintain the integrity of a marriage over a span of many years. In this regard Professor Baragatti could provide several examples on this topic, but doing so would violate privacy and might require even more band-aids, so we will not get into that.



Hood fix



Vacuum cleaner fix

NONA GIORNATA (NINTH DAY)
STORIES CONNECTED WITH HISTORY

The stories narrated during this day are somewhat related, directly or indirectly, to historical events or personages. While the characters and actions are totally fictitious the facts related in the background are true. Hopefully the stories convey the importance of historical adherence to facts, without which no moral purpose could even be claimed. And of course, just like the other stories, they contribute to the unity of the book by having a connection, direct or indirect, to some aspects of the world of physics.

Principles of optics illustrated with horse demonstrations in the eighteenth century. Three Italian men visiting the first great exhibition in London in the Victorian era. A computerized extension of the numerology in Tolstoy's War and Peace. Geodetic measurements and love relations in the Kingdom of the Two Sicilies. These and other stories are narrated during this day.

Pentameron

The Decameron by Giovanni Boccaccio consists of one hundred stories, written in ancient but classical Italian, and told over ten days by a group of refined young men and women. Less known is the Pentameron, which consists of fifty stories, written in ancient Neapolitan dialect, and told over five days by a group of unrefined (to say the least) women. The Pentameron, whose proper title is The Tale of Tales, was written in the 1600s, in Baroque style, by Giambattista Basile, a poet and courtier. The stories in the Pentameron had some popularity in Germany and were later adapted by The Brothers Grimm, who made extensive, acknowledged use of Basile's collection. Examples of this influence are versions of Cinderella, Rapunzel, Puss in Boots, Sleeping Beauty, and Hansel and Gretel. The book was translated into Italian by Benedetto Croce, a famous Italian philosopher and historian, then retranslated into English from Croce's version. In these translations the language was sanitized, for example by removing words considered to be offensive, with the result that the original writing was watered down and its vulgar flavor was lost. More

recently a brilliant new translation from the Neapolitan into English by Nancy Canepa has become available[1]. This version is incredibly amusing to read, since it preserves the original style (down to earth and below) of the author.

Giambattista Basile

The story below includes excerpts from Canepa's translation of Basile. The excerpts are in italic typeface. The stories in the Pentameron are fantastic and almost always have a happy ending; they are populated by talking animals, repulsive ogres, and fairies of stunning beauty. In this modern version the ogres and fairies have been replaced by a professor of quantum mechanics and by a beautiful policewoman.

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Jennifer Palmieri was walking down a street in Chicago. She was a very pretty twentysomething of Italian descent, and she was furious. She had just walked past a meat packing site, moving gingerly because of the state of the road and of her high heels, while some workers were unloading quarters of beef from a truck. One of them had noticed her, and had felt that she represented *the quintessence of softness, the prime cut of the most delectable of all meats, and the flower of all tenderness.* Well, maybe not exactly in those terms. In fact, he had mumbled a rude comment as she was passing through, not so softly that someone like Jennifer, who had the most sensitive ears, could not pick it up. The comment sounded like: "Piece of …," to which she had been able to resist her natural impulse to respond with a vulgarity and had maintained a ladylike demeanor.

She was furious, though. "Piece! Can you imagine? Piece! In this day and age," she thought, "this language should not be tolerated." She remembered her Italian uncle, "zio" Antonio, using the term "pezzo di...," and her

Brazilian relative, “tio” Gonçalo, using the term “pedaço de….” “Men are all the same,” she thought. “However, Sean is different, he has always respected me.”

Sean O’Brunch was her boyfriend, obviously of Irish descent. He was a very nice young man, quiet and very respectful. Although he was still uncertain about his future and had not applied to any university, he was somewhat interested in physics and metaphysics and was currently trying to learn and understand things on his own. Not an easy thing to do in this modern, complicated world. But Sean was trying and, since his head was sometimes in the sky, he would occasionally pull a nonsensical mathematical formula out of it (the sky, that is, not his head), and scribble it on whatever piece of paper was at hand.

When Jennifer arrived at Sean’s apartment, he was not there, since he had gone to help a neighbor put up some Christmas lights. He had left the door unlocked, so his girlfriend entered and sat on a sofa. After a while, pulled by *curiosity, which is the prime endowment of women,* she went to his desk and looked at the pile of papers messily distributed on it. At the top, she noticed what looked like a draft of a holiday greetings card, addressed to her. The draft started as follows:

Dear Jennifer I love you. You are the best but stopped abruptly and was followed by what looked like a mathematical formula, something that must have suddenly appeared in Sean’s weird mind. The formula looked like this:

$$\prod e^{ce}$$

Jennifer, who was studying the classics and was familiar with the Greek alphabet, read this as

pi ece

and reacted furiously. “Piece? Is he calling me piece?” And she started walking back and forth in the room until Sean came back. She immediately turned on him *with a face like a mother in law*, and the poor guy was invested with a torrent of words.

“Piece, huh? Is that what you think I am, a piece? Well, you are a piece of you know what, and I will give you a piece of my mind. *You worthless thing, you dope, shithead, bad pisser, leaping goat, diaper ass, hangman’s*

noose, bastard mule!"

Sean was flabbergasted at this sudden outburst. He tried to explain that the formula (which by the way was dimensionally nonsensical) involved a product, an exponential, the speed of light and the charge of the electron, but nothing succeeded in calming down the young woman. She stormed out in a rage declaring that their relationship was over and she would not want to see him again.

After Jennifer left, Sean was very depressed so he left the apartment and spent several hours wandering aimlessly around the city. Eventually he wandered into a park and sat on a bench, looking very sad. And that is where he made contact with Professor Gordon Stinkberg.

This professor was really a horrible creature, who had a double life. He was a loner who was teaching some quantum mechanical courses at a private university on the outskirts of Chicago. As would be found out later, he had also committed some monstrous crimes in the basement of his house.

For these crimes, which included torture and human flesh consumption, he would later be sentenced to multiple life sentences without possibility of parole. He was, in essence, comparable to some of the ogres described in the Pentameron, since he was *the summary of all misfortunes, the register of all deformities, the ledger of all ugliness.*

His appearance was scary. His *hair was like a broom made of dry branches, not to sweep dust and cobwebs from houses but to blacken and smoke our hearts*. His *eyes were comets that predicted shaky legs, wormy hearts, frozen spirits, diarrhea of the soul, and evacuation of the intestines.*

This professor Stinkberg sat down on the bench next to Sean, who, in his state of despondency, did not even notice the weirdness of this individual. Stinkberg, with a mellifluous voice, started to mentor him. Taking advantage of his knowledge of physics, the monster told the young man that he could teach him extraordinary truths, and convinced him to be driven to his house. The professor's house was very isolated, located *into a wood – where the trees formed a palace for the meadow so that it wouldn't be discovered by the Sun.*

Pretty soon Sean found himself tied to a laboratory table in the basement of the house, a place that had been converted to a torture room. The site conserved signs of the horrible crimes that had been committed there, and smelled terribly.

At this point in a Pentameron story a beautiful fairy would appear and perform a miracle that would free the prisoner, punish the villain, and set everything straight. In this modern version, the fairy takes the form of Lieutenant Thelma Lewis, of the Chicago Police department, who, by all considerations, was a very unusual cop.

She was the most resplendent thing you could find on the whole earth: her hair was a set of handcuffs for the cops of Love, her forehead a tablet on which was written the price list for the shop of the Graces of amorous pleasures, her eyes two lighthouses that signaled the vessels of desire to turn their prow toward the port of joys, her mouth a honeycomb amid two rose hedges.

Notwithstanding all that, Lieutenant Lewis had spent countless hours on the computer piecing together bits of information from different sources, while investigating trafficking of young women. And then a miracle happened, - a miracle of science, that is - with a convergence of elements from physics, chemistry, meteorology, forensic biology, marine biology, climatology, artificial intelligence, nanotechnology, archeology, volcanology, psychology, seismology, astrology, genetics, linguistics and so on. And in this convergence of elements Lieutenant Thelma noticed a trail leading to Professor Stinkberg.

And that is why, all of a sudden, an armada of law enforcement officers materialized at the house of Professor Stinkberg. The Chicago Police department, the FBI, Interpol, SWAT teams from several counties, helicopters, robots, the Delta Force, the Royal Mounted Canadian Police, the Marines, and so on conducted a fast, brilliantly coordinated rescue operation which resulted in the liberation of Sean O'Brunch and in the capture of the perpetrator.

When Jennifer Palmieri, already remorseful for her behavior and regretting having freaked out earlier, heard about all this, she came running and tearfully embraced her boyfriend, thus assuring that a happy ending was reached.

And when Lieutenant Thelma Lewis was interviewed about the difficulty encountered in the resolution of the case, she just said: "Well, it was not exactly a piece of cake."

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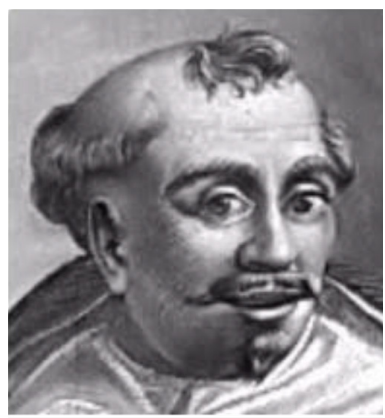
(1) G. Basile, *The Tale of Tales,* or*, Entertainment for Little Ones*, ed. and transl. N. L. Canepa, Detroit, 2007.

A Recast of an Old Story

This story is a recast or adaptation of a story (Novella XIX, First Book) by Matteo Bandello (1484 – 1561). Bandello was an Italian Dominican friar from the Renaissance period who wrote 214 stories, most of them dealing with erotic relationships. The collection of stories bears some similarity to the Decameron, as it offers an insight in the social customs and mores of the time, and the writing is probably racier and naughtier than Boccaccio's. In the present adaptation only the names of the characters have been maintained; time and locations have been modified. It is our belief that the more modern setting and related technological advances make the entire story more credible.



Matteo Bandello

Matteo Bandello used to preface each of his stories with a dedication to an important personage of the epoch - prince, courtesan, ambassador, *gentildonna* - or some such character, of which categories he seemed to know an almost infinite number. Every dedication ended with the words *state sano* or *state sana*, depending on gender, and translated as "stay healthy." The subtitle to Bandello's Novella XIX reads like this:

Faustina and Cornelia, women of Rome,
become prostitutes and, with cunning,
are held in the highest regard by their husbands.

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Marco Antonio was a rich young man in Rome. Being rich, he had been spoiled by his parents. He was extremely smart, so smart that he had

become an assistant professor of theoretical physics at the University of Rome. He was also strange, maybe he was bipolar. At some point he married a beautiful woman by the name of Faustina, who by family and wealth appeared to be a sensible match, although she was much more daring and experienced than him. Not long after the wedding Marco Antonio happened to meet a woman by the name of Cornelia who was considered to be one of the most beautiful women in Rome. She was married to a good-for-nothing man who did not care for her and spent all his time in places of ill repute. For some reason Marco Antonio fell crazily in love with this Cornelia and started walking by her house often, sending her ardent messages, flowers, and very expensive gifts. After a while the woman informed him that, if he did not have a wife, she was willing to escape with him to any place in the world.

When Marco Antonio heard this, he was so blinded by his passion that he decided to kill his wife, sell all his possessions, and escape with Cornelia. So, he started getting rid of all his properties and converting the money to gold and gems. Somehow, Faustina, through hacking and stolen e-mails, got wind of this plot and prepared a defense. She acquired a sexy rubber doll similar to her own size, filled the inside with a red dye simulating blood, added some remote controls, and placed it on the bed where she usually napped in the early afternoons. Marco Antonio had found out that a small ship, which was used to smuggle migrants from Africa, would soon be leaving for Libya, and had made an arrangement with the captain. He then entered the room where his wife was supposedly sleeping and stabbed the mannequin twice, which emitted some painful sounds. Convinced that he had killed his wife, he then left the mannequin in the street among piles of trash. In those days trash collection in Rome had been suspended and nobody would notice.

He then took a big trunk, containing all the gold and gems that he had amassed, and went to the boat with Cornelia, who had dressed like a man. Faustina, who knew all the details of the plot, dressed like a Spanish prostitute (she spoke Spanish very well). She also went to the boat, where the captain was very glad to take her on board. During the navigation, Faustina exerted her new profession very well and more than satisfied the crew and passengers. Marco Antonio was spending most of the time under the deck guarding his treasure. Yet, he had noticed the Spanish woman, and thought that she quite resembled his recently deceased wife. So, he decided that he should also have a try with the Spanish courtesan, and he approached her. As he did, the woman screamed with a strongly accented

voice: “You bastard, you just killed your wife and ran away with a married woman! May you burn in hell! If I had a hundred thousand holes made to satisfy men, I wouldn’t give you a single one! Go away!” Marco Antonio found himself completely confused and without words.

At that moment the weather changed, and a tremendous tempest arrived. In order to save the ship, the sailors started to throw cargo into the sea. At one point they also brought up the heavy trunk that contained the treasure of the two fugitives, who tried unsuccessfully to keep it aboard. In fact, Cornelia was so attached to the trunk that when a big wave came, she and the trunk were both swept into the water.

The furious winds pushed the ship toward Sicily, until it crashed on some rocks near a beach. The survivors took off in different directions and Marco Antonio was left alone on the beach, or so he thought. Actually, Faustina was watching him. Now Marco Antonio was truly despondent, he had lost his wife, his lover, and his money. So, he decided to kill himself. He tried to hang himself with his belt, but the belt broke. He asked Faustina, who had observed the scene, to let him use her veil. She reluctantly agreed and he attached the veil to a branch, but this time the limb broke. “You low life!” cried Faustina, “Not even the trees want to support your miserable carcass!”

Marco Antonio was desperate and did not know what to do. Then Faustina said: “I am Giulia from Barcelona, and if you promise me that you will change your ways, I will stay with you and we can work together.” So, they went on to the nearest city, which happened to be Palermo, where Faustina resumed her work and Marco Antonio became her protector. Due to her beauty, she was very successful, and this is how she took revenge on her husband.

Eventually, some relatives of Faustina’s found out that Marco Antonio was living in Palermo with a Giulia from Barcelona, a woman of dubious morality. They suspected that he had killed his wife (even though the body had never been found), and, through the police or the mafia, had let it be known that they were going to have him killed. Faustina found this out through her connections. Since she did not want her husband to be killed, she said: “Since you say that I resemble your wife, I will tell your relatives that I am in fact your wife and that we escaped together and that we are free to do whatever we want with our life.”

Some of the relatives had come from Rome and it was easy for Faustina to

convince the relatives that she was in fact the wife of Marco Antonio, since she knew all about their previous life together. They had lost all their fortune at sea, and that is why they had come to live the way that everybody knew. That threat removed, they continued with their arrangement.

Now, with all this, we have lost track of Cornelia. After falling into the sea, she remained attached to the trunk containing the treasure, and was eventually deposited on a beach. After being rescued by a good woman, whom she generously compensated, she first associated herself with a sailor, then with a second one who stole all the treasure and left her penniless. She eventually ended up in Palermo, where she took residence in the red-light district and started a successful business, duly aided in this by a man that she had taken on as her protector.

Marco Antonio had noticed the new very beautiful arrival in the district and had not recognized Cornelia. One day, after he had sent his wife on a business trip for a few days, he approached Cornelia with obvious intentions. Immediately the two recognized each other, and the woman started screaming: "You bastard, you killed your wife and you abandoned your lover who gave up everything for you! Go burn in hell!"

She would not have anything to do with him. The unfortunate man found himself with both his wife and his lover working in the red-light district, and both of them were denying him what was readily available to most. But, no matter what, his old passion for Cornelia was reignited, and he tried in many ways to get her away from her protector. Cornelia's protector, fearful of losing the income from Cornelia's efforts, informed Faustina.

At this point Faustina decided to end the charade. She talked to Cornelia and convinced her to go with Marco Antonio on a Mediterranean cruise that would end up in Rome. Then she contacted an aunt of hers who was the mother superior of a convent in Rome and told her the entire story. The aunt told her to come right away, and Faustina quickly arrived in Rome. Here, she sneaked into the convent, and went into the abbess's cell. After some time, the nuns heard some noises and suspected that the mother abbess was having a man in her cell. To dispel these rumors, the abbess presented Faustina as a poor woman whom she had sheltered while she recovered from a tragic experience.

"My husband," said Faustina, "tried to kill me and left me for dead. But, because of a miracle by the Madonna of Loreto, I was instantly healed and

not a scar was left on my body. Thanks to my aunt I have been hiding here while recovering my piece of mind." All the sisters were moved and had no trouble believing the story.

By this time Marco Antonio and Cornelia had arrived in Rome. The abbess had sent a message to Marco Antonio, saying that she needed to talk to him. Since she had great moral authority, and in the past he had always respected her, he went as soon as possible to the convent. Here, after having been received with much love, he was told that, if he renounced his past sinful life, he could get back his honest, saintly wife. At first he could not believe it, because he believed his wife to be dead. But then Faustina appeared, and she told her story, and, after some back and forth, she was convinced to take back her husband, with great satisfaction from all the sisters.

Marco Antonio took Faustina home as a good and saintly woman, even though on sea and land he had seen her give herself to countless scoundrels, and he himself had organized some of that.

Meanwhile, Cornelia's lowlife husband had been killed in a house of ill repute. By then, Cornelia had learned a lot from Faustina. She made it known that she had run away and had spent the time hiding with an old aunt of hers, because she feared her husband's mistreatment and abuse. This was much commended. Now that she was a widow she could marry again, with an honest man, which she did.

Thus, both women were now regarded with great respect by their husbands, proof of how well they had been able to tell their stories.

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The tale above is only a summary of the original one by Bandello, which is much longer, and better developed, as far as the characters are concerned. However, as farfetched as the story may be, we believe that the present adaptation is more credible than the original one by Bandello, due to the technological advances available in the more modern setting. For example:

1) In the original story Faustina hires a craftsman to make a mannequin out of wood, which she covers with some animal skin under which she positions bags full of red dye. She also has to get under the bed and pull some cords to simulate a reaction when stabbed. Much easier today to buy a realistic and sexy rubber doll. And she could also use wi-fi.

2) In the original story Faustina discovers the plot against her by hearing from accomplices who betray her husband. Much easier today by hacking e-mail accounts and the like.

3) And finally, with the discovery of quantum mechanics, it is generally accepted that a system can simultaneously exist in two states, with different probabilities. One can argue whether such states could also include those of being both a prostitute and a saintly woman.

As Matteo Bandello would have said, *state sani*, or stay healthy.

Of Poetry and Pools

It was the year 1280 A.D., plus or minus two years, in Florence. Thirty years before, Cardinal Giovanni Battista Battistoni had been an influential figure in the city. Most likely because of his name, he thought of himself as a kind of reincarnation of John the Baptist. Accordingly, during his initial years in the church, he had secured a large grant from the Pope to build a huge baptismal font in his villa on the outskirts of Florence. This baptismal font was nothing like the ones that you see everywhere in churches today. It was huge; if you knew how to swim you could easily swim in it. After a few years, Cardinal Battistoni's religious fervor started to taper down, likely because of what he had seen taking place at the papal court in Rome. Besides, as with many other white elephants, the baptismal font was not getting much usage, and was gradually becoming more of a sophisticated swimming pool for the elite. After the death of the Cardinal things got even worse. The villa and pool (pardon, baptismal font) were inherited by his nephew, Silvio Battistoni. There were rumors that wild parties were taking place at the villa, even involving underage girls, but those were only rumors and they stayed that way.

Florence was always a center of culture, so it is not surprising that on this particular day two of the most popular Florentine poets were relaxing at the pool to which they had been invited. Guido Cavalcanti and Dante Alighieri were the major exponents of a literary current that came to be known as *"Dolce stil novo*'" or "Sweet new style." This new trend was characterized firstly by the use of "*vulgar*," as the new Italian language was called, as opposed to Latin, which was considered to be the superior language and, secondly, by the idealization of women. At this point in his life Dante was beginning to stray from the *diritta via*, or the right path, as he would later

make clear at the beginning of his immortal poem, the Divine Comedy.

Guido and Dante were sitting at two opposite points at the edge of a circular pool. They were delighted when Madonna Brunetta, a pretty young woman whom they knew well, came in and laid down at the edge of the pool. The two poets started swimming in a straight line towards her.

The figures at the end of our story, obviously not to scale, give an idea of the situation. If you think that women did not wear bikinis in Dante's time, consider that people had great respect for the classical Greek and Roman cultures, and, as can be seen from the mosaics in Piazza Armerina, Sicily, that type of apparel was in use during Roman times.

When the poets reached Brunetta they began reciting verses from their repertoire. Here are some excerpts from their poetry, which, had they not known the young woman, could easily have been considered to be a bunch of pickup lines.

This is what Dante Alighieri said [(1)]:

Madonna, quel signor che voi portate
ne gli occhi, tal che vince ogni possanza,
mi dona sicuranza
che voi sarete amica di pietate.

> Lady, that Lord you bear in your eyes
> in such a way that he overcomes all resistance,
> gives me assurance
> that you'll be a friend to kindness.

and this is what Guido Cavalcanti said[(2)]:

Avete 'n vo' li fior' e la verdura
e ciò che luce od è bello a vedere
risplende più che sol vostra figura:
chi vo' non vede, ma' non pò valere.

> You have, in you, the leaves and flowers
> All that shines and all that's sweet to see:
> Greater than the sun your face in splendour
> Who sees you not can ever worthy be.

After the poets had declaimed their verses, Madonna Brunetta said: "You guys are really full of it. Why don't you do something more useful, like studying science and mathematics." Brunetta had grown up in Pisa, and her

extended family had included the famous mathematician Leonardo Fibonacci (of the Fibonacci numbers fame), so she knew something about the subject. “I am going to give you a problem to solve.” The literature of those days included stories of women who posed riddles to men, following an Egyptian-Persian tradition, and so the two young men felt challenged.

“Dante,” began Madonna Brunetta, “I noticed that you swam over to me for 10 *braccia* (3), and when you arrived Guido was still 14 *braccia* away. Now, I know that this baptismal font is 3 *braccia* deep. Can you tell me how many *barili da vino* (4) can fit in the pool?”

Dante and Guido thought about it but could not solve the problem. Brunetta explained that, because of their initial positions, the diameter and their trajectories formed a right triangle, and so one could apply Pythagoras’ theorem to find the diameter of the pool. With that information the volume of the pool turned out to be 6,946 *barili da vino*. You are welcome to check the calculation.

Dante learned his lesson well. Years later, when he was disgusted with his life and felt that he had lost the *diritta via*, he started writing the Divine Comedy. When he got to the XIII Canto of Paradise, he included a reference to the above geometrical property. In that fragment Saint Thomas explains that the reality found there is totally different from the one that we are used to. He illustrates his point with an example of what on earth would be considered an absurdity: that it would be possible to inscribe in a semicircle a triangle that is not right-angled. Dante expresses this concept with the following verses (5):

o se del mezzo cerchio far si puote
trïangol sì ch’un retto non avesse.

> Or if, within a semicircle, one
> can draw a triangle with no right angle.

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(1) Dante Alighieri, Rime (LVII), translated by K. Foster and P. Boyde.

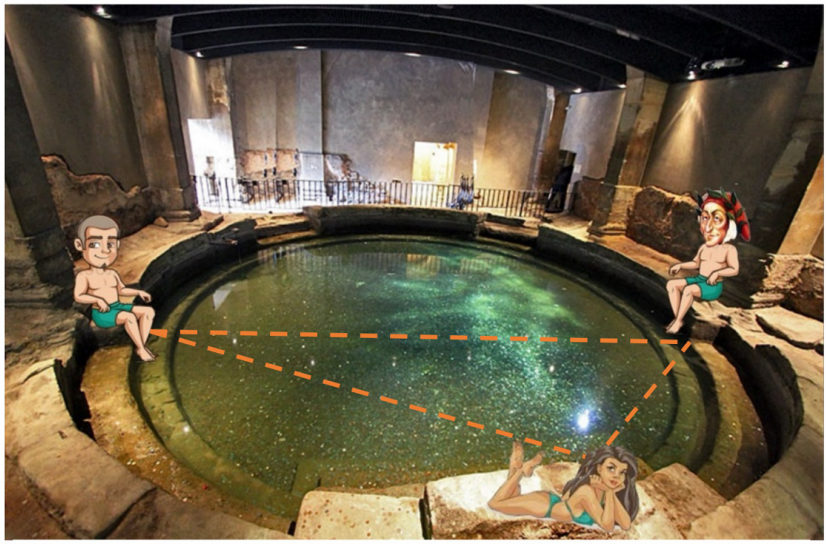
(2) Guido Cavalcanti, Poesie, translated by A.S. Kline.

(3) Braccio (plural braccia) fiorentino, Florentine arm (0.5836 meters), was a unit of linear measurement, so called because it measured like the arm of an adult person.

(4) In Florence, a liquid volume unit of measurement was the barile da

vino, wine barrel (45.58 liters).

(5) Dante Alighieri, Divina Commedia, Paradiso (XIII, 101) translated by A. Mandelbaum



Guido Cavalcanti, Dante, and Madonna Brunetta
at the Battistoni baptismal font, XIV Century A.D.

Mosaics in Piazza Armerina, Sicily, IV Century A.D.

Proust and Chemistry

Henri Valencien was a chemistry instructor at a college in Angers, the administrative center of the Maine-et-Loire department and, as with most cities in France, an important historical site. He was about thirty years old, single, and not bad looking. One reason why he was still unattached was that he was totally dedicated to chemistry, more specifically to quantum chemistry, to the point that he had cut himself off from all other branches of human knowledge, including literature and art. I would call him a fanatic. At some point he had become sick, probably because of a viral infection, and had spent a few days at a hospital. After his release, it was recommended to him that he take a period of rest to fully recover, and he decided to spend two weeks at a village in the Pyrenees which was famous for the quality of its air and water.

That is why Henri Valencien was now staying at the Hotel du Lion d'Or, one of the many inns in the village offering half and full board. He had taken the half board offer, which allowed him to go for long walks during the day, and have dinner at the hotel in the evening. There were other vacationers at the inn and throughout the village. They tended to be generally older than Henri, and many were retired. As expected, they were an interesting if not representative sample of the population at large. Amelie and Françoise were two sisters in their seventies who had likely retired from an intelligence service, as evidenced by their interest and inquisitiveness about other people's business. Jean Jacques was a restaurateur from Provence, who had recently retired and sold his brasserie. He was mostly interested in food and could usually be heard making critical comments while comparing the local cuisine to the one he had left behind. There was also a married couple from Paris, who were celebrating some precious stone anniversary. They stayed mostly by themselves. And then there was the Countess of Forcheville, or so she called herself, and her niece Estelle. Estelle was a quiet blond twenty-something-year-old girl, with a face that Henri would have said had been painted by Botticelli, if he had known who Botticelli was. He did not, so he did not say anything.

When the mayor of the village, who was also the main promoter of tourism, heard that a man of science was boarding at the Lion d'Or, he politely asked Henri if he would be willing to give a talk, on a subject of his choice. This, figured the mayor, would offer a diversion and break the monotony of the village life for the vacationers.

Henri Valencien, who was beginning to get bored himself, readily agreed. Two days later, posters appeared on the windows of the local shops

announcing that Professor Henri Valencien would give a talk on

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in the only (and seldom used) conference room at the Lion d'Or.

Reactions to the announcements were mostly enthusiastic. The two sisters Amelie and Françoise were anxious to learn what kind of chemistry was responsible for the weird love relationship of Swann and Odette, characters in Marcel Proust's opus. Jean Jacques, the restaurateur, was a fan of breadmaking and had tried baking any kind of baguette, bagel, pretzel, ciabatta, tortillas, and so on from Helsinki to Sicily and beyond. He thought to himself: "Maybe this time I will discover the secret of the famous *madeleine* and its effects on memory." The Countess of Forcheville anticipated the description of an era and a society to which she should have had the right to belong, had she been there. Her niece Estelle, who had taken notice of Henri Valencien, and who was inspired by the charm of the Duchess of Guermantes, was eagerly looking forward to the talk. The only one who had an adverse reaction was a stock broker from Paris, who behaved snobbishly by being anti-snobbish. "Proust, Proust, again," he said to himself. "Today it seems that if you haven't read the 2,400 pages of his book you are a moron. Most people have not, but you just mention the name Proust and they will gush over it. It is sad to see that even men of science have fallen prey to this fad."

The time for the talk came and about thirty people packed into the room at the Lion d'Or. Henri started by saying that he was mostly honored to pay tribute to a great man, who had laid the foundation for the impressive development that was to follow, and who had been born in the same city as himself. "Strange," thought Jean Jacques, "from his accent I would have thought that he was from Angers, not from Paris, especially the Auteil district."

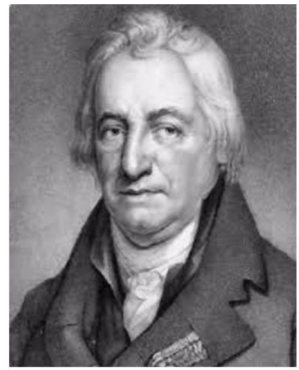
As Henri kept talking people started to look a bit disconcerted. After stating that Proust did some of his best work at a time of wide unrest and of great revolution, Jean Jacques asked: "Are you referring to the Russian Revolution?" "No, I am referring to the French Revolution!"

"Are you sure?"

"Yes, I am positive."

"With all due respect, young man, I do not know what kind of virus you are positive of, but, in the name of God, can you tell us who is the person you

are talking about?"



Joseph Louis Proust
(1754-1826)

"Why, I am talking about Joseph Louis Proust, of course, who discovered the Law of Constant and Multiple Proportions that, when you think about it, points you straight ahead to the atomic theory. Whom did you think I was talking about?"

"But Marcel Proust, of course, the immortal author of ALRDTP."

"I am afraid I am not familiar with that chemical formula."

Marcel Proust
(1871-1922)

"That is what we use as shorthand for 'À La Recherche Du Temps Perdu.' It is a shortening habit that we have acquired from America," explained Jean Jacques patiently.

At this point the embarrassment in the room was so thick that you could

have cut it with a knife. It was denser than chocolate mousse, something in between liver pâté and Camembert cheese. The suspense was broken by Colonel Bertrand Dehorse, an authoritative retired military officer, who told Henri to continue and tell his story.

And that is when Henri rose to the occasion. He was a good lecturer, and modified his talk by minimizing the scientific content and concentrating on the human aspects of the men and women of science who, after the initial discovery by Proust (Joseph Louis that is) had advanced the atomic hypothesis to almost where we are today. He skipped rapidly to the time of La Belle Époque, which was the period that Marcel Proust experienced and described, and which was also, arguably, one of the most fertile in scientific discoveries.

Röntgen, Becquerel, Pierre and Marie Curie, Einstein, the love affair of Marie Curie and Paul Langevin, the untimely death of Moseley during the First World War, and even a Duke, Louis de Broglie, all came to life during the talk and made the listeners realize that the world of chemistry (and physics) was as rich and diverse as the one created by Marcel Proust. At the end of the talk there was an enthusiastic applause and Henri was thoroughly complimented.

The following day Estelle joined Henri for a walk in the woods and this became a habit for the duration of his vacation. The two young people went on long walks entering dense parts of the forest where the sun that was coming over from the Riviera could not penetrate and peek at them. The relationship between Henri Valencien and Estelle de Forcheville lasted longer than the vacation, with varied developments. An acute mind would have been capable of finding similarities between their relationship and the love story of Charles Swann and Odette de Crécy.

Of Epic Poems and Drugstores

In 1933 Paul Adrien Maurice Dirac was awarded the Nobel prize for physics. When he was interviewed in Stockholm he admitted, among other things, that he was not interested in literature. By the late 1950s his attitude must have changed (he was married by that time), since he was reading Russian novels, including *War and Peace*. He also read Dostoevsky's *Crime and Punishment*, which he thought was "nice," though he pointed out that "In one of the chapters the author must have made a mistake; he

describes the sun as rising twice within the same day."

It is highly doubtful that Dirac ever read the *Orlando Furioso* by Ludovico Ariosto. If he had, one wonders if he would have also found some inconsistencies in it. We say this because of the amazing complexity of the *Orlando Furioso*, which is an epic poem written in the middle of the 16th century. The *Furioso* contains numerous interlaced stories set against the background of the war between Charlemagne's Christian paladins and the Saracen army that had invaded Europe, about 800 years earlier. Many themes are interwoven in its complicated episodic structure, but the most important one concerns the paladin Orlando's unrequited love for the pagan princess Angelica, which drives him mad. This Angelica is always running, chased by knights of all kinds - Orlando, Rinaldo, Ruggiero, Sacripante, etc. - as well as by other lower characters, until she finds her true love and exits the story in the middle of the poem.

*****

Because he was aging, Professor Gianluca Baragatti needed to refill an increasing number of prescriptions. He usually filled these at the Pillmart drugstore. There were usually three employees at the counter, but for some reason Gianluca always managed to be served by the same employee, who happened to be a very attractive brunette. A tag on her white uniform indicated that her name was Angelica.

Professor Baragatti had realized that age had one advantage. He could say things to young women that he would not have dared to say when he was twenty. Always in good taste, of course! Just innocent jokes, *omnia munda mundis*. But he liked to say funny things, or so he thought. For example, when you pick up prescribed medications at the pharmacy you are asked to verify your date of birth. In response, he would occasionally say "September 29, 1938" and, after a brief pause, add "after Christ." He had done this, once, with Angelica, obtaining an uncertain smile and a puzzled look in return.

And once he had tried to tell the young woman that her name was famous in Italian literature, but she did not appear to be impressed.

One day, while Gianluca was waiting for his prescription to be filled and was looking at Angelica as she worked behind the counter, he was reminded of a passage (there are many) in Ariosto's poem describing feminine beauty. The following verses from the Canto XI of the Orlando Furioso describe a woman, Olimpia, who is tied naked to a rock and is

about to be eaten by a marine monster. She is saved by Orlando, who kills the monster. Earlier on, in Canto X, Angelica (the princess) had found herself in the same situation and was saved by the knight Ruggiero. Ariosto's women seem to have a propensity to be chained naked to rocks.

Ruggiero Rescuing Angelica by Gustave Doré

67
Le bellezze d'Olimpia eran di quelle
Che son più rare: e non la fronte sola
gli occhi e le guance e le chiome avea belle,
la bocca, il naso, gli omeri e la gola;
ma discendendo giù da le mammelle,
le parti che solea coprir la stola,
fur di tanta eccellenza, ch'anteporse
a quante n'avea il mondo potean forse.

67
Her beauty is indeed beyond compare:
Not only on her brow, her eyes, her nose,
Her cheeks, her mouth, her shoulders and her hair
The observer's glance may with delight repose,
But from her breasts descending, down to where

A gown is wont to cover her, she shows
A miracle of form, so exquisite
None in the world, perhaps, can equal it.

68
Vinceano di candor le nievi intatte,
ed eran più ch'avorio a toccar molli:
le poppe ritondette parean latte
che fuor dei giunchi allora allora tolli.
Spazio fra lor tal discendea, qual fatte
esser veggiàn fra picciolini colli
l'ombrose valli, in sua stagione amene,
che 'l verno abbia di nieve allora piene.

68
Whiter than snow unstained by the earth's smutch
The perfect lily-whiteness of her skin
And smoother far than ivory to touch;
Like milky curds but freshly heaped within
Their plaited moulds, her rounded breasts, and such
The gently curving space which lies between
It calls to mind a valley 'twixt two hills
Which winter with its snowy softness fills.

69
I rilevati fianchi e le belle anche,
e netto più che specchio il ventre piano,
pareano fatti, e quelle coscie bianche,
da Fidia a torno, o da più dotta mano.
Di quelle parti debbovi dir anche,
che pur celare ella bramava invano?
Dirò insomma, ch'in lei dal capo al piede,
quant'esser può beltà, tutta si vede.

69
Her lovely hips, the curving of her thighs,
Her belly, smooth as any looking-glass,
Her ivory limbs, were rounded in such wise
They might have been the work of Phidias.
Those other parts which to conceal she tries
I will, as it behooves, in silence pass,
Content to say that she, from top to toe,

Embodies all of beauty man can know.

"I could not have done what Orlando did," thought Gianluca. "Regrettably I could not have saved Angelica."

One day Professor Baragatti and Berenice went to Pillmart together with Augusta, a very old lady whom Berenice regularly assisted and who needed to pick up some medicine. Augusta was at least ten years older than Gianluca who, in his heart, always thought of himself as looking younger than his age. While Berenice was in another part of the drugstore picking up some beauty products, Gianluca and Augusta walked up to the pharmacy section. Once the transaction was completed, Professor Baragatti, who was distracted as usual, asked for the receipt.

"I just gave it to your wife," said Angelica, pointing to the receipt in Augusta's hand. Professor Baragatti's jaw dropped.

When Gianluca rejoined Berenice, he took her aside and meekly said: "You know, the lady at the counter thought that I was married to Augusta." "You certainly could be," said Berenice, and she had a good laugh.

Suddenly Professor Baragatti felt that he was really old, and he was reminded of another passage from the *Orlando Furioso*. It still involves Angelica, but this time it does not involve a knight. The princess is tricked into drinking a poison by an old hermit who wants to take advantage of her. However, because of his age, he does not succeed and ends up falling asleep next to her. The following verses from Canto VIII give a down-to-earth description of the situation.

49
Egli l'abbraccia ed a piacer la tocca
ed ella dorme e non può fare ischermo
Or le bacia il bel petto, ora la bocca;
non è chi 'l veggia in quel loco aspro ed ermo.
Ma ne l'incontro il suo destrier trabocca;
ch'al disio non risponde il corpo infermo:
era mal atto, perché avea troppi anni;
e potrà peggio, quanto più l'affanni.

49
And, as defenceless in his arms she rests,
Embracing her, he touches her all over,
Kisses her mouth and both her lovely breasts.

The rough and lonely place gives perfect cover,
But in this joust his weary jade resists.
For all he longs to prove himself a lover,
Years having undermined his aptitude,
The more he strives, the less he can make good.

50
Tutte le vie, tutti li modi tenta,
ma quel pigro rozzon non però salta.
Indarno il fren gli scuote, e lo tormenta;
e non può far che tenga la testa alta.
Al fin presso alla donna s'addormenta;
e nuova altra sciagura anco l'assalta:
non comincia Fortuna mai per poco,
quando un mortal si piglia a scherno e a gioco.

50
Whatever methods he experiments,
His lazy courser simply will not jump;
Nor will it lift its head in consequence
Of any jerking rein, or spur, or thump.
To sleep beside her, then, is less expense.
But Fortune will not leave him there to slump
In such inertia; having ill begun with him,
She schemes, as is her wont, to have more fun with him.

"Well," thought Professor Baragatti, "I definitely do not belong in the Orlando Furioso. The bad news is that I could not have saved the princess. The good news is that I would have never put myself in the second situation."

"I hope so," thought Berenice, who, in a mysterious way, most of the time could read her husband's mind.

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The translations quoted above are from Barbara Reynolds (1914-2015), a British scholar of Italian Studies, biographer and translator who lived a very long life.

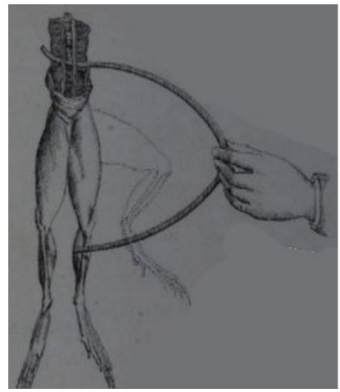
Ariosto, Ludovico (1975). Orlando Furioso (The Frenzy of Orlando). Part One. Translated by Barbara Reynolds. Penguin Classics ISBN 978-0-140-44311-0

Ariosto, Ludovico (1977). Orlando Furioso (The Frenzy of Orlando). Part Two. Translated by Barbara Reynolds. Penguin Classics. ISBN 978-0-140-44310-3

Of Frogs and Legs

Around the year 1780 people did not have clear ideas about the nature of electricity, just as today we do not have clear ideas about the nature of love. Some machines existed that could produce and even store some electrostatic charge, and could generate sparks, mostly for entertainment purposes.

Around the same time, Luigi Galvani (1737 -1798), who was a professor of medicine at the University of Bologna, and an expert at dissecting animals to study their nervous and muscular systems, happened to notice that his freshly prepared frogs were kicking their legs in response to electrical sparks. The observation sent him on an extensive search for the effects of electrical phenomena, including lightning, on frogs. Eventually, and luckily having avoided being electrocuted during thunderstorms, he realized that external sparks were not needed. Merely connecting nerves and muscles to a metal conductor was sufficient to develop convulsions in the legs of the sample animals. This led him to the conviction that the electric fluid, as they called it at the time, resided within the frog itself.



Alessandro Volta (1745 -1827), who was a professor of physics at the University of Pavia, repeated the experiments and came to the conclusion that the electricity was external to the frogs. The scientific debate on the two theories went on for several years, but eventually Volta's position was recognized as correct. In the process, he invented the battery. Galvani was not totally wrong, he was the first to notice and investigate electrical effects in nerves, and is considered the father of neurophysiology. Both Volta and Galvani were geniuses, and whoever wrote the following lines apologizes to them for utilizing their names for the purpose of spewing out some questionable humor.

*****

It was a nice summer evening in Paris, in the year 1895. There had been some thunderstorms, and the temperature had dropped to a comfortable level. It was the height of La Belle Époque, as it would later be called, and multiple art forms were flourishing in the city. Operettas and ballets were popular forms of entertainment, and the music by Offenbach, French Can-Can and the like, set the tone.

Two gentlemen were spending the evening together. They were Count Gaston de la Toilette and Baron Gervais du Bidet. They were the perfect example of the fauna that populated *À la recherche du temps perdu* and were the type of people who had the resources and the connections to really enjoy La Belle Époque.

"Mon ami Gervais," said de la Toilette, "I have heard that at Les Folies Bergère they have put on a new ballet called Galvani. It seems that they have beautiful dancers with fabulous legs."

"I have heard that too. Let us go there. Besides, the Duchess Oriane de la

Douche will be pleased to host us in her private box."

Since they had left their private carriages at their homes, the two friends took a cab. Actually, it was really a fiacre, a two-seat vehicle pulled by a single horse, and thus they were driven to the Folies Bergère. The following is a brief synopsis of the performance.

The first act opens with a wild dance by young women made up to vaguely resemble frogs. The frog nation has seen the abdication of the last king and has transitioned to some form of republic. Now there is going to be an election to choose the President. The most favored candidate is a big frog by the name of Lotharius, who is promoting a rightist agenda and is holding big rallies. The motto of his campaign, 'Make Amphibians Great Again,' succeeds in turning out huge crowds. The first act ends with the victory and the election of Lotharius, and is celebrated with dances and a great display of legs.

The second act opens in a somber tone. A chorus of frogs describes the situation a few months after the election. The new president has turned out to be a disaster and the frog nation has experienced all kinds of misfortunes. Lotharius has become more and more dictatorial and his subjects are living in fear. After the chorus, the scene changes to a laboratory in Bologna. A few frogs in various states of dissection are seen hanging all around. Luigi Galvani is in deep thought; he resembles Faust at the beginning of Goethe's poem, before the entrance of Mephistopheles. He has conducted a number of experiments using electricity but has not yet figured out a theory to explain his observations. In addition, healthy frogs have become increasingly scarce and he is having trouble continuing his research. Suddenly Lotharius appears and proposes a deal. He will provide an endless supply of frogs if Galvani promotes a theory that will help Lotharius in keeping the support of his base. According to the proposed theory frogs are exceptional, since they themselves contain the electrical fluid that appears in the experiments. The act ends with more dances celebrating the exceptionality of frogs, and an even greater display of legs.

The beginning of the third and final act shows dancers being prodded with metal arc conductors and swinging their legs vigorously according to the stimulus. The scene then turns to Lotharius who has made a lot of money by selling his subjects and has decided to go to Paris to live it up. In Paris Lotharius runs into Greta Dreamberg, a Swedish animal activist. For unknown reasons she kisses him and turns him into a prince. Unfortunately for Lotharius, this happens at the height of the French Revolution. An

angry mob seizes Lotharius at the cry of 'Down with Royalty' and cuts off the head of the newly created prince. With the demise of Lotharius the frogs go back to a simpler existence. They are not so exceptional after all. At the conclusion of the ballet, a battery of Napoleonic guns enters from the left side of the stage. Alessandro Volta appears from the right side. He is pushing a huge battery which is really a huge pile of discs of different metals, separated by leaky conductors. The guns discharge first, then two dancers carefully connect the poles of Volta's battery, resulting in a huge spark and a sound that overpowers the sound of the guns. The act ends with a French Can-Can dance and a grand kicking of legs.

"The sound of that spark was phenomenal," said Gervais du Bidet. "It was more powerful than the Bonaparte's battery of guns."

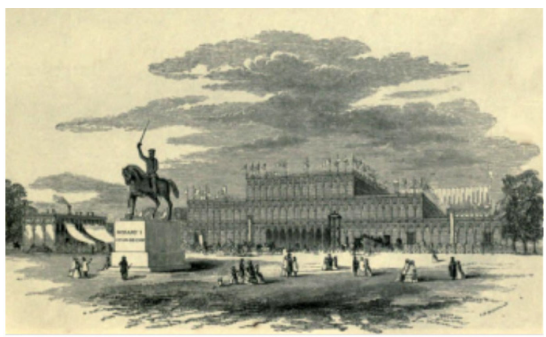
"And that is probably why today we use the word battery for what should really be called a pile," said Duchess Oriane de la Douche.

Count de la Toilette, Baron du Bidet, and everybody else thoroughly enjoyed the ballet. The two gentlemen thanked Oriane for her hospitality and left the Folies Bergère.

"Let us take a cab, I mean a fiacre, and go to La Grenouille," said de la Toilette. "It is a little restaurant near Place d'Italie. The great grandfather of the chef helped Galvani in preparing frogs for his experiments, and I can assure you that their frog legs are really exceptional."

The Great Exhibition

One of the first international expositions took place in London from May 1 to October 15 of the year 1851. It is generally known as the Great Exhibition and was organized under the auspices of Queen Victoria and her husband Prince Albert. In addition to England, many foreign states participated. The exhibition was an enormous success, with six million people visiting it. The official catalogue lists 44 foreign states participating. Of these, 13 are now part of what is today Germany. Italy does not appear in the list since Italy was not a single nation at that time. However, three parts of the territory participated, namely Sardinia, Tuscany, and the Papal States. At that time the Kingdom of Sardinia was not limited to the island, and included parts of the peninsula with important industrial cities such as Torino and Genoa. Sardinia provided 97 exhibits, while Tuscany and the Papal States presented 123 and 57 items respectively. The presence of these three states is significant as the following story will show.



Entrance to the Great Exhibition

The exhibition took place in an enormous building, called the Crystal Palace, that covered 20 acres, and was built in only nine months. The official catalogue provides a fascinating view into history. In addition to a description of all the items exhibited and beautiful drawings of some of them, it contains scholarly articles on the separate areas of human activity that were presented at the exhibition, thus providing a convenient overview on the status of different topics, including science and technology.

The Main Avenue inside the Crystal Place

*****

In the month of September, 1851, three individuals found themselves in London, for reasons related to the Great Exhibition.

Umberto Monferrato had been sent by the government of the Kingdom of Sardinia to visit the exhibits and learn about new technologies that could benefit the state. He was an engineer by training and was interested in all kinds of scientific progress.

Eugenio di Trevi, Marquis of Gattapelata, was sent by the Grand Duke of Tuscany for similar reasons. He was mostly interested in the arts, and also in the progress being made with materials and techniques employed in the fabrication of objects of art.

Last but not least, Monsignor GianMaria Gurmetti was a member of the bureaucracy of the Papal States, and it was not clear why he was there, except that he enjoyed travel, food, and, according to gossipers, occasional intimate company with both sexes.

These three gentlemen, coming from Torino, Florence, and Rome, did not previously know each other. Once they met, because of their shared language, they started up a relationship that improved their quality of life during their stay in London.

“I am lodging at an inn,” said the Monsignor. “The rooms are not bad, but the food is a different story. I especially dislike the bacon that they serve in the morning, it is nothing like the *pancetta* or *guanciale* that we have in Rome. And the rest of it is not very appealing.”

“I agree, the food is strange here,” said Monferrato. “I am tired of greasy mutton, and I am longing for tagliatelle with porcini, and our wine from the Langhe.”

“My friends, I have been luckier,” said Eugenio di Trevi. “I am a lifelong friend of the Earl of Watchamacallitt, who is now on an extended trip to visit his lands in the Far East. He is gracefully letting me use his palace, where he has left a limited but more than sufficient staff; this includes a cook who is well versed in continental cuisine. The Earl has been my guest in Florence many times, and I am sure he would be happy to extend his hospitality to you guys, since his palace has many empty rooms.”

Monferrato and Monsignor GianMaria gladly accepted the offer and the three men started spending more time together. Besides visiting the exhibition several times, and attending to their specific interests, they also took advantage of London’s evening offerings. The Exhibition, and the enormous influx of people, had multiplied the number of activities (not all of them legal) to satisfy the appetites of hordes of visitors. One evening, while visiting a fair in a local district, the three men noticed a tent where an old gypsy woman was predicting the future.

“Unlike you, Monsignor, I do not believe in these spiritual things. But I will try, just for the fun of it,” said Monferrato.

“You do that, my son, and, just to prove that we men of the cloth are also men of the world, I will go next,” said GianMaria Gurmetti.

“Hah!” thought Eugenio di Gattapelata, “He is the last person who would have to prove that,” he mused, while debating whether he should also get his future predicted. Eventually all the three men paid the small fee and entered the tent in sequence.

Monferrato was the first to speak: “Some prediction of the future indeed! The old woman only said, ‘Your town will become the capital of a new state,’ and I already live in a capital.”

“But that is exactly what I was told,” said the Monsignor.

“And I heard exactly the same words,” added Eugenio. “I suspect that the old woman tells the same thing to everybody, but what do you expect for a penny. Having said that, it is better for Umberto and I to spend our money on younger women who may not predict the future but may provide a pleasant present.”

“And I will pray for your repentance,” said the Monsignor, who was planning to attend a Bible retreat at a property owned by the Jesuits which was at a walking distance from what would today be called a gay bar or maybe a gay pub.

In the following days, the three men visited the various sections of the Great Exhibition. Umberto Monferrato had a friend that was working on the catalogue and had been privileged to see some preliminary write-ups on the items presented. Because of his scientific and technical background, he was in a position to illustrate the features of the most modern artifacts.

Chair in ebony and ivory

When visiting the Sardinia section, Monferrato complained that he had not been listened to during the selection of the exhibits from his state. Art objects, and products from agriculture and food processing, were the major part of what had come from Sardinia. An example was an exquisite chair, inlaid with ebony and ivory, made for the King of Sardinia. Torino had a good school of engineering and there were people working on electricity and magnetism who could have provided examples of their work. In Umberto’s mind that would have been more significant than, as beautiful as it was, the chair on which King Victor Emanuel II (the future king of Italy) and probably his mistress would be resting their butts.

In fact, electricity was now a subject of great interest, and examples of its application were present throughout the exhibition. Many new ideas and gadgets had come from the United States, which, according to the catalogue, had a total of 599 exhibits. It had been recognized that great forces could be obtained by running currents into electromagnets, so it was reasonable to think that one could apply this to moving machinery. Unfortunately, since the creation of electricity required chemical reactions, electromagnetic power was considered to be impracticable. This was on account of its cost, which was estimated at the time, under the best conditions, to be at least one hundred and fifty times more expensive than

steam power using coal!

The majority of electrical gadgets presented at the exhibition dealt with the telegraph. As important as this method of communication was, Monferrato feared that it might grow into a web of wires extending to all houses, with the result that every idiot and his brother would be constantly exchanging silly text messages with similarly inclined individuals, with unknown and questionable impact on society.

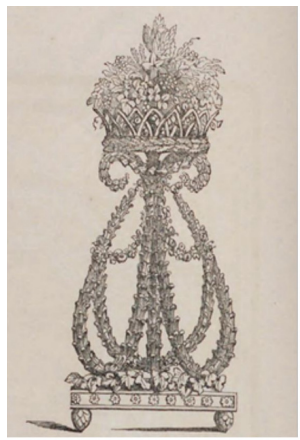
Metal alloy bell

Advances in the science of metallurgy were also prominently displayed in the exhibition. Monsignor Gurmetti knew that bells made only of iron did not have a pleasant tone and was impressed by the sound of a huge bell from the Netherlands. He realized that the addition of a small amount of metal could improve the pleasure to his ears as much as the addition of minor amounts of spices to a dish could improve the pleasure to his palate.

The Papal States displayed items that were more of interest to people with appreciation for art versus science. During the visit, Monferrato pointed out that the only item from that section to be reproduced in the catalogue was a statue of Glycera, whoever she might have been, but a half-naked woman nevertheless.

Statue of Glycera

As expected, Tuscany had a large display of art objects, but also contributed many things of impressive scientific interest. Most significant was a series of beautiful wax models that illustrated the galvanic system of a fish known as the electric ray. In the words of a contemporary reviewer "...these are most exquisitely copied from some of the most careful dissections which have ever been made of this extraordinary electrical arrangement... the cell connection with the nervous system... appears to lay open to us the processes of electrical excitation as connected with the phenomena of vital action."



Bronze cast from nature

Among the 123 exhibits displayed in the Tuscany section was a large basket of flowers formed in a single bronze cast. The piece attracted great

attention, because of the technique used in its production. Real leaves and flowers were lightly suspended in a box, into which was poured very liquid plaster of Paris. When this compound, which would find its way into every part, was perfectly set, the mass was exposed to a heat sufficient to burn the vegetable matter, without in any way altering the mold. The ashes being shaken out, the metal was poured in, and then an exact facsimile of the object was obtained.

Since the wheels of history inevitably keep turning, the sojourn in London came to an end, and the three men made separate return trips to the capitals of their respective states. As for the Earl of Watchamacallitt, who had generously allowed them to use his palace, he died when his ship went down in a storm during his return trip from the Far East, and his heirs were left to fight over his wealth.

*****

On March 17, 1861, following some victorious battles against the Austrian Empire and an instigated insurrection in the South, Torino became the capital of the newly created kingdom of Italy. On February 3, 1865, Florence became capital of Italy. And lastly, on October 2, 1870, following a plebiscite, Rome officially became the capital of Italy. The pope considered himself a prisoner and the Vatican did not recognize the Italian state for almost fifty years.

Thus, all the predictions of the old gypsy woman became true. Umberto Monferrato was sent by the government to Sicily to direct civil engineering projects, an almost impossible task. Count Eugenio di Trevi retired in his estate at Gattapelata and continued to support the arts. Monsignor GianMaria Gurmetti maintained his post in the Vatican bureaucracy and was assigned to oversee the spiritual well-being of the Trastevere district, an area of Rome famous for its trattorias and folklore.

Triangulations

This story takes place in Puglia, Italy, circa 1860. In order for it to make sense, we need a brief introduction: technical, geographical, and historical.

*****

Suppose that you are given a triangle. If the triangle is not too big (relative

to your size, that is), it is easier to measure the length of its sides than the angles at its vertices. But, if the triangle is very large, the opposite is true, and it is easier to measure the angles. This is why the technique of triangulation is used in astronomy and geodetic surveying. There is no need to insult the intelligence of our readers by explaining the technique, which requires the measurement of a segment, or base-line, and two angles, to determine the position of a far-away point. It is obvious that the length of the base-line must be measured very accurately in order to minimize errors with subsequent triangulations, which may be part of a network developed from the first one.

The following figure gives an idea of how the measurement of a geodetic base-line was carried out in the 1800s. A small number of standard bars of known length were carefully aligned while being gradually moved along the path of the base-line. While this may seem simple and similar to the process used to measure a piece of fabric, things were actually quite complicated. The standard bars included levels and thermometers to correct for the metal dilatation with temperature; the gap between two bars was measured with special instruments. The length of the base-line was measured twice, in both directions, and the difference between the two results was usually of the order of a few millimeters, over distances of a few miles, according to quoted results.

APPARATUS FOR MAKING AND BREAKING CONTACT IN MEASURING BASE-LINE.

The region of Puglia was once part of the *Regno delle Due Sicilie* (Kingdom of the Two Sicilies) which from 1816 to 1861 included all of Southern Italy. The cartography of the entire kingdom was based on a single base-line near Naples measured in 1821. In 1856 a decision was made to measure a new base-line in Puglia, near the city of Foggia. The methodology and results from the project are described in the following document found in archives by Professor Gianluca Baragatti.

The document describes a base-line measurement that was performed during the summer of 1859 near Foggia, in the region of Puglia. The measurement occurred in a place known as San Pietro in Bagno, a locality near the town of Lucera. While San Pietro in Bagno, which can be translated either as Saint Peter in the restroom or Saint Peter taking a bath, cannot be found on Google Maps, you can find there another town by the name of San Piero in Bagno (also in Italy, but in the Emilia Romagna region).

SULLA

MISURA D'UNA BASE GEODETICA ESEGUITA IN PUGLIA

NOTA

DEL CAV. FEDERIGO SCHIAVONI

Ingegnere Geografo, Professore di Geodesia

ON THE

MEASUREMENT OF A GEODETIC BASE IN PUGLIA

NOTE

BY CAV. FEDERIGO SCHIAVONI

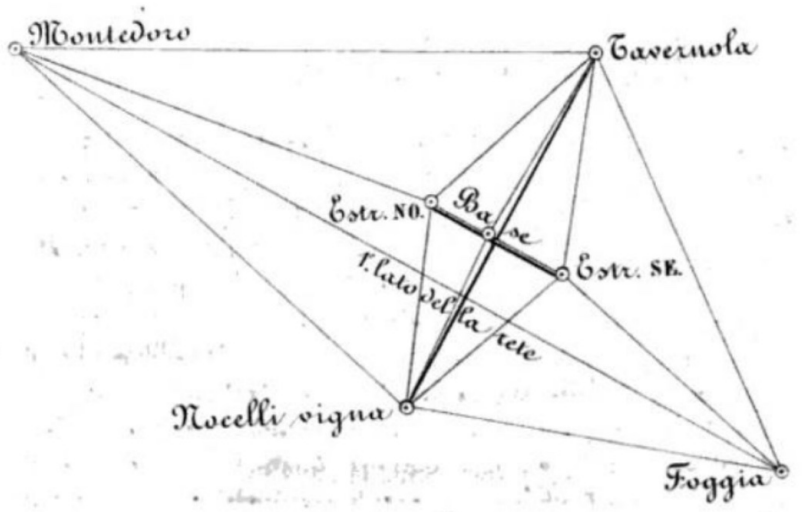
Professor Baragatti, unable to locate the place on Google Maps, at first thought that the name had been totally discontinued. However, he later found a recent reference to the locality or *contrada* of San Pietro in Bagno through a historical website that also lists names of places in the area using the local dialect, as follows:

Sambapasquale: Chiesa e convento di S. Pasquale (al Belvedere);

Sambitre in Bbagne (a): San Pietro in Bagno. Contrada dell'agro lucerino, a sinistra sulla via per Foggia;

Professor Baragatti was happy to find out that *Sambitre in Bbagne* (!) is in fact a locality in the Puglia region near the town of Lucera, to the left on the way to Foggia. But he was even happier, because of his Brazilian connection, to see an adjacent item in the list; he found out that the church and convent of San Pasquale are known locally as *Sambapasquale* (!). He would love to visit that church and convent someday.

The 1861 document shows the triangulations that the *Officio Topografico* in Naples was planning to do at the time:



Now, this type of work (at least at that time) was usually carried out by a combination of civil engineers, scientists, cartographers, etc., with substantial help from the army, not least because of the need for manpower to prepare the terrain, cut down trees, provide a line of sight, and so on. The document acknowledges the important contribution of six individuals, of which four were in fact army officers.

The base-line measurement was carried out. However, the document says that the triangulations that would have connected the new base-line to the geodetic network were not completed, because of *le emergenze politiche del 1860*. The 1860 political emergencies were the occupation of Sicily by Garibaldi, with the subsequent deposition of King Francesco II of the House of Borbon, and the annexation of the South to the Kingdom of Italy. While those triangulations must have been restarted and completed at a later time, we have reasons to believe that other triangulations continued to take place.

*****

Ferdinando Baccarini, Count of Costapelosa, was the last descendent of an aristocratic family that in previous years had exerted considerable influence in the region of Puglia. As often happens in prominent families, power as well as wealth becomes gradually diluted with successive generations, and Ferdinando, while maintaining his nobility title and some privileges, did not have the status and influence that the family had maintained in the past. He lived on one of his properties in the area known as San Pietro in Bagno,

near the city of Foggia, with a limited number of servants, and derived a sufficient income from other properties on the island of Sicily, properties that, in spite of the stealing and mismanagement of their administrators, were sufficient to support his standard of living. Gone were the days when the Baccarinis were giving lavish parties and were participating at events at the Court in Naples. However, compared to the miserable life of the peasants in the region, the Count of Costapelosa was extremely well off.

Ferdinando was about sixty years old, not particularly attractive, and had been a bachelor for all his life, cultivating a close relationship with the monks at the convent of San Pasquale, where the ways of the Lord knew no limits. Until, that is, he married Lola. Now, this Lola was the young daughter of Gaspare Vergani, a very smart peasant who had slowly increased his wealth with a combination of contraband and real estate acquisitions. Lola was also, arguably, the most beautiful and sexy woman in the area, although not the most literate. Think of Claudia Cardinale in the movie "The Leopard," based on the book "*Il Gattopardo*" by Giuseppe Tomasi di Lampedusa. Gaspare was determined to increase his social, not only financial, standing, and thought that a union with the Costapelosas would be highly beneficial to his descendants, so he convinced his daughter to marry the old count.

Lola was not particularly happy with her new status and, even though she appreciated certain comforts that had come with her new position, sometimes she acted snappily toward her husband.

Count Ferdinando di Costapelosa was interested in science and had some influence on the limited social activity in the area. When the work for the geodetic base-line was planned, he offered to assist.

Lt. Rodolfo Valentini was a young artillery officer that was part of the team in charge of the base-line and triangulation measurements. He was good at trigonometry and could help with the calculations. He was also tall, very attractive, and had a suave Neapolitan demeanor.

Count Ferdinando invited Lt. Valentini to stay in his villa for the duration of the operation. "Please come, *tenente*. Staying here, close to the site, will make it easier for you to carry out the triangulation project. Let me introduce you to my wife."

You may guess what followed. This subject has been dealt with at length and in detail by better writers than the present one. The ones that come to mind are Flaubert (*Madame Bovary*), Tolstoy (*Anna Karenina*), Goethe

(*Elective Affinities*), but there must be many others. While the stories related by those authors had various, sometimes tragic endings, we know that Lt. Valentini stayed a long time in the villa of Count Costapelosa. And Lola appeared to be much happier, and did not snap anymore at her husband.

But inevitably there was gossip. Doctor Calogero Arcicorvo, the physician from the neighboring town of Lucera, who as a youth had worked in France, voiced the popular opinion:

"Triangulation, triangulation…This looks to me more like ménage à trois."

And the gossip must have also been the reason why the name of Lt. Valentini, in spite of his valuable contributions, was not included along with those of the other officers acknowledged in the scientific document found by Professor Baragatti.

Of Horses, Kaisers, and Khans

The events of this story take place sometime during the first decade of the eighteenth century. At that time the Holy Roman Empire, which was neither holy nor Roman anymore, was fragmented into a number of German independent states. One of these states, the Buttenburg (do not try to find it), was ruled by an Elector, Wilhelm Wilfried von Karchoffen, of the house of Mortdhollen.

As a German prince entitled to take part in the election of the Holy Roman Emperor, Wilhelm's proper title was Elector, but he had come to be called Kaiser, a title that would later be used for someone with a much larger authority. Let us say that he was a *minor* Kaiser. Wilhelm was an eclectic man, with many interests, among them natural philosophy (mostly physics), horses, and women, not necessarily in that order.

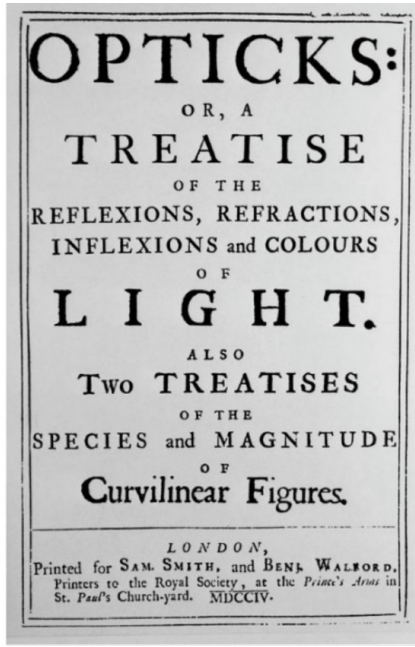
He insisted on promoting arts and science and somehow viewed himself as continuing the tradition of the Medici family. Accordingly, his court was populated with artists, scientists, and scholars from various countries. He spent most of his time with a small group of expatriates that included William Stirspeare, an English playwright, and Madame de Pompigné, a former lover with an addiction to letter writing. Also in the group was Francisco Amorim das Boas Vidas, who had actually been born in Brazil as the illegitimate son of a Portuguese aristocrat, had slightly darker skin, and

painted tropical sceneries. Last but not least was Giambattista de Vongolis, a romantic poet who came from the kingdom of Naples. He was considered avant-garde because the romantic movement would only appear a century later.

In his youth, when he was not yet a Kaiser, Wilhelm had taken a long trip, and had reached some regions of Eastern Europe that were at that time ruled by Tatar people. While there, besides developing a taste for steak tartare, he had also begun a lifelong friendship with a young man by the name of Razil, who later would rule that area and become known as Mexis Khan.

Over the years, the Kaiser and the Khan had maintained their friendship. On the occasion of the wedding of one of his daughters and taking advantage of a period of relative peace, Wilhelm invited his old friend Razil to attend the festivities, for which many events were planned.

On such occasions, horses often had a big part in the pageantry. However, people did not do tournaments anymore; that form of entertainment, along with the image of the errant knight, was a thing of the past. Wilhelm thought of combining his passion for physics and horses by staging an illustration of a physics principle. Because he had been reading the 1704 treatise “Opticks” by Isaac Newton, he chose refraction. Wilhelm first gave a lecture on it to the wedding audience. According to Newton’s theory white light is composed of corpuscles of different colors. When they enter a new medium, the red ones go faster, the violet slower, and as a result they spread around.



OPTICKS:

OR, A

TREATISE

OF THE

REFLEXIONS, REFRACTIONS,
INFLEXIONS and COLOURS

OF

LIGHT.

ALSO

Two TREATISES

OF THE

SPECIES and MAGNITUDE

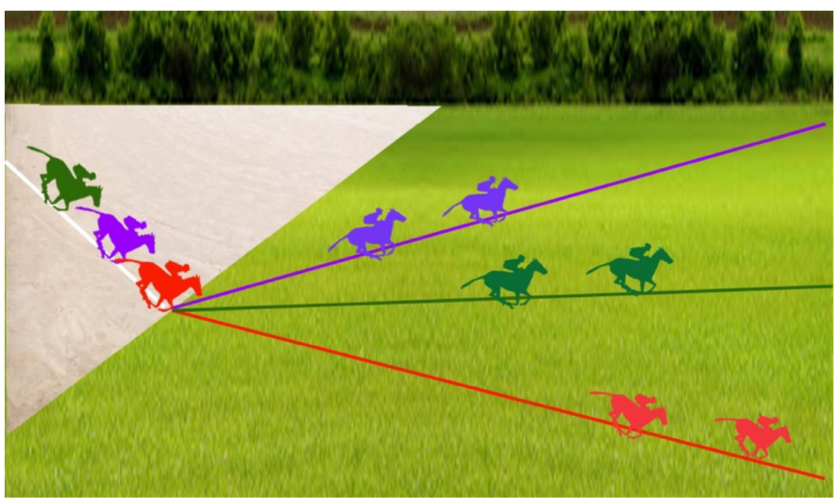
OF

Curvilinear Figures.

LONDON,

Printed for SAM. SMITH, and BENJ. WALFORD,
Printers to the Royal Society, at the *Prince's Arms* in
St. *Paul's* Church-yard. MDCCIV.

This was magnificently illustrated by a train of horsemen, all draped in different colors. They entered the grass as a single line, at high speed, then immediately took different paths according to their color. and it looked like a rainbow! They then regrouped and repeated the demonstration.



Mexis Khan was very impressed and asked many insightful questions. It turned out that he also had a passion for physics and horses (and for

women, we may add). In fact, he may have been the only one, apart from the Kaiser, to really appreciate the significance of the presentation. The demonstration was repeated several times to the delight of the spectators, and afterward everybody thanked the Kaiser.

“Thanks to the Kaiser,” said William Stirspeare.

“Merci au Kaiser,” said Madame de Pompigné.

“Obrigado para o Kaiser,” said Francisco Amorim das Boas Vidas.

At the end of the exhibition the last horse came a bit too close to the grandstand where important people were sitting, and stepped into a puddle of mud and shit that, unfortunately, splattered on the Italian romantic avant-garde poet.

“Grazie al Ca... I mean... grazie al Kaiser,” said Giambattista de Vongolis.

*****

A few years later, on the occasion of the wedding of one of his sons, Mexis Khan organized some festivities. He felt it was his duty to invite his friend Wilhelm and his cultural entourage to attend the celebration. Since those parts of the world were still in a state of relative peace, the Kaiser and his party made the trip.

And it was well worth their effort! The festivities were fantastic. Mexis Khan had devised an exhibition that combined his passion for both physics and horses. A large field was divided by a tall fence which had a very narrow aperture, barely enough for a horse and his mount to get through. A stream of Mongolian horsemen appeared and charged straight to the opening, riding at very high speed. Amazingly, all of them made it through and continued in a straight line. The spectators were impressed with the equestrian ability of the performers in getting through the narrow passage at such high speed.

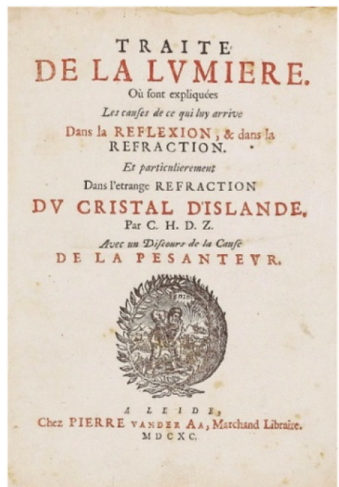
“But wait for the second part,” said the Khan, and he ordered that a modification be made to the fence. This time there were two narrow passages, quite close to each other. And the horsemen came running again, at high speed. There was some dust and one could not really tell which horse was going through which opening. Most amazingly, after passing the fence, the horses separated into several well-defined distinct streams.

The spectators applauded but they were puzzled by the meaning of the demonstration.

“My dear Khan,” said Wilhelm, “what does all this mean?”

The Khan smiled: “Waves and Interference, my dear Kaiser.” He then

proceeded to explain his deductions from applying the wave theory of light, which he had learnt from a deep study of the Christian Huygens work *Traité de la Lumière*, published in 1690. Only the Kaiser understood the explanation. He thought that the Kahn's ideas were very avant-garde since, as far as light is concerned, it would take another century to verify them; the Kaiser opted to stick with Newton. Everyone else just appreciated the extraordinary equestrian ability of the Mongolian riders and thanked the Khan profusely for organizing such a magnificent pageant.


TRAITE
DE LA LVMIERE.
Où sont expliquées
Les causes de ce qui luy arrive
Dans la REFLEXION, & dans la
REFRACTION.
Et particulierement
Dans l'etrange REFRACTION
DV CRISTAL DISLANDE.
Par C. H. D. Z.
Avec un Discours de la Cause
DE LA PESANTEVR.
A LEIDE,
Chez PIERRE VANDER AA, Marchand Libraire.
M D C X C.

"Thanks to the Khan," said William Stirspeare.

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"Grazie al Ca... I mean... grazie al Khan," said Giambattista de Vongolis.

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It is unfortunate that the Kaiser and the Khan are not with us anymore. If they were, we can only speculate, with all the developments in modern physics, what kind of magnificent horse pageants they would have treated us to.

Numerology

Paul Dirac is famous for his contributions to physics, and also for his weirdness. Not surprisingly his biography by Graham Farmelo, published in 2009, is titled *The Strangest Man*. The book includes several anecdotes attributed to Dirac, most of which seem to be a direct consequence of his determined and uncompromising logic. In his early life Dirac was interested only in physics, as confirmed when, after receiving the Nobel Prize, he gave an interview during which he admitted that he did not care for literature, theater, or music. However, after meeting and marrying a woman with a very different personality from his own, he became more normal, and even developed an interest in Russian novels. After reading Dostoyevsky's *Crime and Punishment*, he is quoted to have said: "It is nice, but in one of the chapters the author makes a mistake: he describes the sun as rising twice on the same day."

Apparently, he also read Tolstoy's *War and Peace* with the same attention to detail. It took him two years.

Professor Gianluca Baragatti (whose only feeble similarity to Dirac might be the fact that he also became more normal after meeting and marrying Berenice), had in recent days also begun to read *War and Peace*. In doing so, he was probably motivated by the news of a war that was currently raging in the same geographical area as described in Leo Tolstoy's masterpiece. In fact, Gianluca felt that the first chapter of Book 9, which deals with a portion of the year 1812, could apply almost word for word to the current conflict if just the names of the countries and characters involved were updated. But Professor Baragatti did not have the same attention to detail as Dirac did, and he read the book at much higher speed, probably finishing it in about three weeks.

In the middle of the book, he found a reference to a prophesy that involves the Antichrist, the Bible, the Hebrew alphabet, the Freemasons, and numerology. This is complicated to explain, so the relevant section (as translated by Louise and Aylmer Maude, 1952) is duplicated in the figure below.

In chapter 13, verse 18, of the Apocalypse, it is said:

> Here is wisdom. Let him that hath understanding count the number of the beast: for it is the number of a man; and his number is Six hundred threescore and six.

And in the fifth verse of the same chapter:

> And there was given unto him a mouth speaking great things and blasphemies; and power was given unto him to continue forty and two months.

The French alphabet, written out with the same numerical values as the Hebrew, in which the first nine letters denote units and the others tens, will have the following significance:

a	b	c	d	e	f	g	h	i	k
1	2	3	4	5	6	7	8	9	10
l	m	n	o	p	q	r	s		
20	30	40	50	60	70	80	90		
t	u	v	w	x	y				
100	110	120	130	140	150				
z									
160									

Writing the words *L'Empereur Napoléon* in numbers, it appears that the sum of them is 666,[1] and that Napoleon was therefore the beast foretold in the Apocalypse. Moreover, by applying the same system to the words *quarante-deux*,[2] which was the term allowed to the beast that "spoke great things and blasphemies," the same number 666 was obtained; from which it followed that the limit fixed for Napoleon's power had come in the year 1812 when the French emperor was forty-two. This prophecy pleased Pierre very much and he often asked himself what would put an end to the power of the beast, that is, of Napoleon, and tried by the same system of using letters as numbers and adding them up, to find an answer to the question that engrossed him. He wrote the words *L'Empereur Alexandre, La nation russe* and added up their numbers, but the sums were either more or less than 666. Once when making such calculations he wrote down his own name in French, Comte Pierre Besouhoff, but the sum of the numbers did not come right. Then he changed the spelling, substituting a z for the *s* and adding *de* and the article *le*, still without obtaining the desired result. Then it occurred to him: if the answer to the question were contained in his name, his nationality would also be given in the answer. So he wrote *Le russe Besuhof* and adding up the numbers got 671. This was only five too much, and five was represented by *e*, the very letter elided from the article *le* before the word *Empereur*. By omitting the *e*, though incorrectly, Pierre got the answer he sought. *L'russe Besuhof* made 666. This discovery excited him. How, or by what means, he was connected with the great event foretold in the Apocalypse he did not know, but he did not doubt that connection for a moment. His love for Natásha, Antichrist, Napoleon, the invasion, the comet, 666, *L'Empereur Napoléon*, and *L'russe Besuhof*—all this had to mature and culminate, to lift him out of that spellbound, petty sphere of Moscow habits in which he felt himself held captive, and lead him to a great achievement and great happiness.

[1] Including a 5 for the letter e dropped by elision from the le before Empereur.—TR.
[2] Forty-two.

The prophecy, based on numerology, is a method that converts letters to numbers and transforms a string of letters into a number, for example the magic number 666, which is supposed to represent the beast. And also 42, the number of years the beast will exist. *L'empereur Napoleon* was converted into 666, and Napoleon was 42 years old at that time. What sorcery! Gianluca found himself wondering how long it took Tolstoy to come up with the words *L'russe Besuhof* to get 666, by converting and adding by hand. And this required eliminating an e and using a French spelling of the name of Count Pierre Bezukhov, the central character of the novel.

Professor Baragatti was intrigued. Unlike Tolstoy, he had a computer. Using the functions INDIRECT, ADDRESS, and SUM, which can be

found in Microsoft Office Excel, he put together a simple spreadsheet. After typing in one's chosen words, the tool would instantly provide the result of the conversion and addition.

Now, you have to know that Professor Baragatti enjoys cooking. However, while he can get excellent results with simple traditional food, he always created a disaster when attempting to prepare French *haute cuisine* dishes. His efforts to duplicate *Boeuf Mode en Gelée*, *with great crystals of aspic that look like blocks of transparent quartz*, as described by Marcel Proust in *À la Recherche du Temps Perdu*, resulted in utter failure. And he did not have better luck with *galantine de canard*.

Now, armed with an automated algorithm, he started experimenting by typing words into the spreadsheet. After a number of attempts, which hopefully took less time than that invested by Tolstoy, he converged on the following: *the bad high chef Gianluca Baragatti*, which, according to the formula, converted to the magical number 666. But what about the other part of the prophecy, the number 42? It is interesting that it gives also 666. But only when you spell it in French, *quarantedeux*; Italian, Spanish, Portuguese, and English spellings do not result in the magic number. And that makes sense, because French was the language the Russian aristocracy spoke and was enamored with at the time of the Napoleonic wars.

"Well," thought Gianluca, "in a few months I shall be 84 years old. Does that mean that I shall have lived twice as long as the beast? Maybe I am twice the beast!" Professor Baragatti had been toying with the idea of making something like *pâtes fraiches au foie gras aux magrets et aux truffes.* However, considering the numerological result just attained as a confirmation of manifest destiny, he opted to make *spaghetti alla carbonara* instead.

DECIMA GIORNATA (TENTH DAY)
STORIES CONNECTED WITH CONTROVERSIAL SUBJECTS

The stories narrated during this day are somewhat related to controversial issues, like the death penalty, the regulation of firearms and of driver's licenses, and attitudes toward religions. Could someone feel offended by these stories? We would not exclude that possibility! If the story contains a connection to sex, that should not be considered controversial. Hopefully the stories convey a sense of nonconformity, without which no moral purpose could even be claimed. And of course, just like the other stories, they contribute to the unity of the book by having a connection, direct or indirect, to some aspects of the world of physics.

Study of electromagnetism creates a conflict with a criminal gang. Instruments of nuclear medicine generate violent opposition. Exercise equipment in a fitness center in Los Angeles is used by the Spanish Inquisition of the seventeenth century. Organized criminality recognizes human rights. These and other stories are narrated during this day.

High Tech Death Penalty

Most countries, including almost all first world nations, have abolished capital punishment either in law or in practice. The death penalty is still in use in authoritarian countries and in some Asian democracies, which makes the United States an outlier, as the only Western democracy retaining this form of punishment. Actually, out of the 50 states that form the Union, 23 have constitutionally abolished capital punishment, while 14 others have enacted moratoria or found other ways to formally or informally suspend executions. Only in 13 states, all with Republican governors or legislatures, have executions been carried out recently.

*****

In the early 1990s, John Wayne Sparkle was a very wealthy Republican Congressman from Texas. After having gained some experience in the state House, he had moved on to federal politics and had been elected to the House of Representatives. He was a hardline conservative, definitely in the

extreme wing of the party. He was in favor of restricting immigration, lowering (if not removing) taxes, reducing government interference, and abolishing any form of gun control. He loved his AR-15 and was an ardent member of the National Rifle Association. He was also a devoted member of an evangelical church, to which he donated large sums of his inherited money, and was strongly against any form of abortion. And when it came to law and order he was a firm supporter of the death penalty.

That is why he was angry when the Texas Supreme Court put executions on hold, especially those carried out with the electric chair, because of cruel and unusual punishment.

“What could be cruel and unusual about a bunch of electrons going swiftly through your body.” He knew that when you close a circuit, on a battery for example, electrons travel from the positive end to the negative one. Like most people, he imagined this motion to be relatively fast. Then someone told him that he was wrong and that electrons move slowly in a conductor. A recent calculation by Professor Chianti shows that a current of 10 Amps in a $3mm^2$ copper conductor corresponds to a velocity of the electrons of roughly one meter per hour. And the current in an electric chair is quoted to be something like 7 to 12 Amps.

Congressman Sparkle managed to get elected to an appropriation committee that, among other things, was looking into the financing of a major science project, the Superconducting Super Collider (SSC). The Superconducting Super Collider was supposed to accelerate protons to produce collisions up to 20 TeV (Teraelectronvolts or 10^{12} eV). Eventually the project turned out to be too expensive and was abandoned, while the smaller European Large Hadron Collider, or LHC, was later completed and reached an energy of 13 TeV.

Abandoned Superconducting
Super Collider

Anyway, Sparkle learned a little bit about the proposed collider, and realized that the beam of accelerated protons, even with a current of only about one Amp, would carry a tremendous energy. The particles in an accelerator go around multiple times until they reach the wanted energy. Then they are deflected into a target (or into another beam in the case of a collider), with detectors around to record the event. Sparkle had mixed feelings about spending all that money for pure science and thought that maybe one could dedicate one of the ports to a more practical purpose.

His thinking will be illustrated with some numbers that refer to the European LHC. Remember, the LHC runs at 13 TeV; the SSC would have run at 20 TeV and would have been larger. Therefore, if anything, what we present here would be an underestimate for the super collider.

An AR-15 rifle shoots bullets that weigh m_r =3.56 grams at a speed v_r of about one km per second. Thus, the kinetic energy of a bullet is

$$E_{kin} = \frac{1}{2} m_r {v_r}^2 = \frac{1}{2} \times .00356kg \times (1000m/sec)^2$$
$$= 1780\ joules$$

and the rifle can shoot 45 bullets in one minute.

Now, for the accelerator, let us say that each proton, with a mass m_p of 1.67 × 10^{-27} kg, reaches a fraction β = .99999999 of the speed of light (c = 3 × 10^8 m/sec). Then, the kinetic energy of the proton is

$$E_{kin} = m_p c^2 \left(\sqrt{\frac{1}{\sqrt{1-\beta^2}}} - 1 \right) =$$

$$= 1.67 \times 10^{-27} kg \times (3 \times 10^8 m/sec)^2 \times \left(\sqrt{\frac{1}{\sqrt{1 - .99999999^2}}} - 1 \right) =$$

$$= 1.06 \times 10^{-6}\ joules$$

which corresponds to 6.61 TeV. The LHC has reached 13 TeV (two beam collision) and the SSC was intended to reach 20 TeV.

There are individual bunches of protons in the accelerator pipe, each one containing about 10^{11} protons, so that a bunch carries an energy of about 100,000 joules, more than fifty times the kinetic energy of the AR-15 bullet. And there are almost three thousand of these bunches in the accelerator ring, all arriving in about a tenth of a millisecond. Compare that to the relatively slow rate of the AR-15 (45 rounds per minute) and you see that the accelerator has an incredible advantage. We summarize these results in the following table:

	Energy of a bullet/bunch	Time between rounds
AR-15	1780 joules	1.3 seconds
Accelerator	about 100,000 joules	about .0001 seconds

Just imagine! Bunches of protons, each bunch about 30 cm long, traveling at almost the speed of light, each carrying a huge amount of energy, at an incredible repetition rate. What a dream!

Congressman Sparkle realized that with suitable modifications, the SSC could be used for carrying out executions. One would only have to add a properly designed death chamber to the array of massive detectors around the ring and then, ZAP, deflect the beam and be done. Unusual punishment, maybe, but not cruel, since the effect would be instantaneous. Those liberal judges would stop interfering with the administration of justice.

With these thoughts in mind, Congressman Sparkle lobbied hard for the SSC. In the middle of 1992, while he was campaigning for reelection,

something happened. Some pictures appeared that showed the Congressman sexually involved with an underage girl. It was a tremendous scandal and the Republican party, which in those days had maintained a sense of decency, first stripped him of his membership in the Appropriations Committee, and then agreed to expel him altogether from the House of Representatives. His church, however, pardoned him for his transgressions, after he apologized profusely and made a large donation.

In 1993 Congress cancelled the SSC project, after about two billion dollars were spent and almost 15 miles of tunnels excavated. Undoubtedly there were multiple reasons for the cancellation. Was the absence of Congressman Sparkle from the Appropriations Committee and his disappearance from the political scene a significant factor in the cancellation of the project? We doubt it, but cannot completely discount it either.

The Anger Camera

A gamma camera is a tool used in nuclear medicine to obtain images of radioisotope distributions injected into the body of a patient. This is also known as an Anger camera, from the name of its inventor, Hal O. Anger. The gamma rays emitted by the radioisotope produce pulses of light in a large scintillating crystal. The position of such scintillating events is determined via a clever use of the signals from a bank of detectors, eventually leading to a digital image.

Hal O. Anger
(1920-2005)

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Weakridge is a moderate size town in the northwestern United States. While it is not mentioned anywhere else, and you would not find it in any map or atlas, it has a population of between 50,000 and 100,000 people, predominantly white. Lots of them are farmers, but, due to the presence of some light high-tech industries, there are also engineers, technologists, and others from the variety of support professions that allow the development and functioning of a respectable *comédie humaine*. The standard of living is relatively high, and, as far as politics is concerned, the town is decidedly conservative. The town is large enough to have a decent hospital, which also serves the agricultural region around the town. The hospital is modern and well-staffed.

It was at this hospital that a department of nuclear medicine was eventually formed. Accordingly, an expensive scanning system including rotating gamma cameras was acquired. The local newspaper wrote an article about this expansion, and mentioned that the population would soon be able to benefit from the availability of Anger cameras.

Anger cameras

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Barry Whetstone was a Weakridge local politician who had twice tried unsuccessfully to be elected Mayor. He was very conservative, and was also the local representative of the National Rifle Association or NRA. He was also a devoted member of the Church of the Christissimo, a law-and-order religious group that had splintered from a major fundamentalist denomination and also served as a convenient tax shelter. It was March 31, and the following week there would be an election for City Hall. Barry Whetstone had decided to try again and had mounted a campaign based on extreme conservatism. His efforts were bolstered by events at the national level, and, since he was independently wealthy, he had covered the town with signs screaming BARRY FOR MAYOR!!! In his previous runs he had

been handicapped by reports of sexual harassment and discrimination, which had resulted in opposition from some women's groups.

Barry saw the local paper and was intrigued by the reference to Anger cameras. What the heck are anger cameras? Barry knew a guy who worked at the newspaper, his name was Willy Brockley, who had collected some information for him in the past. This guy Willy was kind of a weasel, and he was good at sensing and spreading rumors. But he was also a tricky guy and he loved to organize pranks. When Barry called him, Willy remembered that the following day would be April Fool's Day, and immediately realized that he could have some fun. The conversation went somewhat like this:

Barry: "Hey Willy, what do you know about these anger cameras that are going to be installed at the hospital?"

Willy: "Ah yes, it is a sad story. These cameras are supposed to measure, using a combination of radiation and artificial intelligence, the state of anger in people. Worse, it is said that they can also assess the state of potential anger, like, you know, the probability that someone will get angry in the future."

Barry: "And why in the world would anyone want to do that?"

Willy: "Well, for one thing they could use the data to limit access to firearms for people with elevated anger potential…"

Barry: "$#@& and %@!# and more @$#^!!!" Those liberals will stop at nothing to limit our Second Amendment rights."

Willy: "You won't believe this, but they are also working on a SEXATT camera which, using a combination of DNA and, again, artificial intelligence, should detect people with attitudes about sex and gender that are not in line with political correctness. You would never pass that test."

Willy had thought that Barry would eventually realize the absurdity of his suggestion, but he did not. Given his innate mistrust for big government, Barry believed what he had just been told and immediately went on the attack. He fired off a message about anger cameras and their nefarious consequences to his base, which was likely more susceptible than him to believing conspiracy theories and the like.

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And that is why the following day, after the sun had chased away the last

shadows of the night, a big demonstration appeared in front of the hospital. Men, women, and children, these latter mostly brainwashed by their parents, carried signs against the evil of the anger cameras.

When the true story was revealed the entire town (well, almost the entire town) had a good laugh. Which also resulted in the third loss for Barry Whetstone and in the election of a slightly less conservative candidate.

Mafia and Racism

One at a time, the black limousines were entering the gate of a large property in rural New Jersey. A casual observer would have thought that they were coming back from the funeral of a very prominent person, someone who had been destined by birth to leave a mark on the world. But the FBI men hiding in the trees that were lining the road leading to the property knew better. This was the biggest meeting of all the mafia bosses since the release of the last Godfather movie. All the families were represented, not just the ones affiliated with the large established organizations - like Cosa Nostra, the ‘Ndrangheta, the Camorra, which had unimpeachable financial reputation and investor backing - but also young upstarts, such as those relying on “gofundme” type platforms on the Internet, were represented.

The gentlemen (yes, they were all gentlemen, no women participating) entered the large colonial-style mansion at the center of the property. After checking some unnecessary items that they were carrying, they were introduced into an elegant reception room where cocktails were served and niceties could be exchanged. “Good to see you again,” said Don Calogero Diotallevi to Don Carmine Santacroce, “How is the family, and how is your son, did you get him started in the business?”

“Don Calò, Don Calò, my son Dominic does not want any part of the business. I do not know what I did wrong, but he is only interested in studying quantum physics and now has a little position at the University in Syracuse. I should have sent him to Siracusa, Sicily, instead of New York State. His cousins would have straightened him out.”

“Do not despair, Don Carmine. I am older than you and, as you know, I had three sons. The first one had a similar experience to yours, he only wanted to do thought experiments. The second one was only interested in women. But, as young people eventually mature and start appreciating the old Sicilian saying *megghiu cummannari chi futtiri* (*), they are both now part of the organization and doing well. The third one is a sad story. He went into the seminary to become a priest, which would have been an excellent profession, but he made the mistake of getting into a religious argument with the Father Superior of the Monastery of Donnafugata and had an unfortunate accident. I am confident that Dominic will come around. But I think that the reception is almost over and the business meeting is going to start soon.”

With that, Don Calogero Diotallevi and Don Carmine Santacroce joined the other attendees and moved to the next room where tables and chairs had been set up strategically, in a fashion that respected the perceived importance of the attendees.

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Before opening the meeting, Don Vito Salviddio, who was unanimously recognized as the oldest and most respected *capo di tutti i capi*, asked for a minute of silence so that Father Salvatore Scacciadiavoli could bless the participants. And after everybody made the sign of the cross, the official meeting began.

“Surely all of you,” began Don Vito, “are aware of what is happening these days in the country. Every day we have huge demonstrations against racism. The nation has been awakened and is finally realizing that for too long we have ignored the plight of a large number of people. And I have discovered with horror that I, and our organization, are also guilty of institutional racism. In order to better understand our past, I have asked Don Ciccio Animasanta to collect some statistics and show us his data.”

The PowerPoint presentation by Don Ciccio Animasanta shocked all those present. The most disturbing viewgraph was one that showed the incidence of *warehouse accidents* by ethnicity. The graph clearly illustrated that

almost the totality of these *accidents*, which regrettably but inevitably were part of the business, involved people of Italian descent, even though the proportion of that ethnicity relative to all communities included in the study was much, much lower.

"This cannot continue, we must take action!" was the most common reaction of the audience. A committee was formed, and a resolution was approved unanimously. We do not have the full text of the document, but the main points were as follows:

1) Implement policies that aim to make sure that business targets are selected without regard to ethnicity, race, gender, sexual orientation, etc. (Father Scacciadiavoli was not too happy with the last one).

2) Create an office of equity and racial justice.

3) Make St. Valentine's Day Massacre a paid holiday.

4) Provide the staff with a course on essential Sicilian dialect.

5) Implement affirmative action for applicants to the above course.

It had been a lengthy meeting, and the sun was almost ready to go to sleep when the black limousines started leaving the New Jersey property. The FBI agents were still hiding in the trees, taking notes and snapping pictures as the cars went by.

*****

A few days after the meeting, the New York Times and other newspapers reported that a person of color had been assassinated in a shootout which, according to the preliminary investigation, had all the characteristics of a mafia settlement of accounts. People that knew felt that the new policies against racism were being taken seriously._

(*) To explain this expression, I chose to copy an excerpt from a book on Sicily:

T. Rakopoulos, From Clans to Co-ops (Confiscated Mafia Land in Sicily) Published by: Berghahn Books

I started visiting local homes, invited by friends, housewives were happy to show off shiny new pieces of cutlery or furniture but shrugged when questioned about the lack of plaster on their house's outfacing walls, often

responding, "It is better to enjoy some luxury without people knowing your riches," or, "Better to show you are a pauper while you actually reign." A neighbour told me a local adage popularised by mafiosi to explain the apparently anti-consumerist local ethos: megghiu cummannari chi futtiri (it's better to command than to fuck). The adage implies that pleasure comes from controlling people, rather than enjoying material luxuries.

An Act of Revenge

Professor Kurt Grinchberg was a seventy-five-year-old retiree who lived alone in a small town in Northern San Diego County, California. Since he had retired from an unexceptional career at a minor university in a midwestern state and, we may add, since his wife had left him, he had become more of a loner. He had no children and almost no friends. He had studied physics at a time when the field was exploding with discoveries, with the major advances made by very young scientists. But he was one of those people of whom Wolfgang Pauli would have said, with his typical caustic irony, "So young, and still so unknown," and he had made no discoveries. Although he was physically in reasonably good health, he had become angry at the world. He had grown a long beard and long hair, and seemed intent to project an image that popular wisdom has labeled *mad scientist*. It should not be strange then that his neighbors, with whom he did not have many interactions, had nicknamed him Professor Grinch. Professor Grinchberg was occasionally seen in the front of his house, tending to a small patch of roses for which he seemed to have a particular affection.

Darryl Aloysius Brown was a vivacious eleven-year-old Black child who lived a few blocks from Professor Grinchberg. He was a good student and would be transitioning from elementary to junior high school the following year. He had lots of friends, had a good sense of humor, and enjoyed outside activities and organizing good-natured pranks. In summary, a very likable kid. And he lived, we may add, in an uncommonly non-dysfunctional family, by today's standards. His father had built a prosperous and well-respected plumbing business and his mother was a teacher at the high school.

One day Darryl and a group of his friends were walking back from an informal soccer game and were kicking a ball down the street. It was a racially diverse group: Latino, Asian, Caucasian. While it represented the

ethnic composition of the neighborhood, Darryl was the only Black child. The group started to pass by the front of Professor Grinchberg's (the Grinch's) house, while he was watering his beloved plot of roses. Unfortunately, the ball, following the laws of Newtonian mechanics, took the path of least action and ended up right in the middle of the professor's roses.

Darryl went to retrieve the ball and was prepared to apologize profusely for the inconvenience. After all, there had not been much damage. But Professor Grinchberg had totally freaked out and had gone ballistic. He was screaming at the top of his lungs and, since he was holding the hose, opened the hand valve fully and directed the jet directly at Darryl who, even though he was very agile, could not prevent being drenched from head to toe. The group of children scattered, not without directing a torrent of invectives in the direction of the professor. The Hispanic kids and one of Italian descent were the most vocal and had the most colorful expletives.

A few days later Darryl had gotten over the episode, but then something happened. As he was walking in the direction of the professor's house (he had to take that route), he saw the old man coming out of the house, lift the lid of the water main, manipulate something, and go back inside, without bothering to reposition the lid. Darryl figured out immediately what was going on (after all his father was a plumber). "The old goat," he thought, "has turned off the water because he is trying to fix something inside. Maybe I can teach him a lesson."

Darryl waited a number of minutes to give "the Grinch" enough time to open up whatever he was trying to repair, then very quickly opened the main's valve and ran to hide behind a tree across the street. He was lucky because he had opened the valve just at the moment when Professor Grinchberg's head was under a kitchen sink, trying to repair a leaking faucet. After a few more minutes, still hiding behind the tree, Darryl observed a strange creature coming out of the house and running to close the valve, this time putting the lid back on top and looking furiously around while mumbling a variety of curses. If you can imagine a *wet mad scientist*, that would be it.

Darryl felt the sweet taste of revenge. "This will teach him not to spray water on people," he thought, "and also to call a plumber instead of trying to fix things himself."

Now, you may think that this story ends here, but that is not the case.

Darryl could not help but inform his friends of what had taken place. Gradually word got around, and most of the neighborhood (except perhaps for Professor Grinchberg) knew what had happened. Eventually even Darryl's father, who had been busy with his plumbing business, heard something about it. He used very convincing arguments to press his son to confess the entire story. "The old man," he said, "could have had a heart attack, passed out, or drowned." Then he arranged a meeting with Professor Grinchberg and took his son there, where the kid apologized for his action. While there, Darryl's father also arranged for one of his men to fix the professor's house plumbing, at no cost.

And guess what? The professor also apologized for being too irritable and for having sprayed Darryl with the hose. Thus began a relationship during which Professor Grinchberg helped Darryl by occasionally tutoring him in mathematics during high school. Now, if you think that they lived happily ever after, you are wrong, things do not go that way in real life.

The DEATH operator turned Professor Grinchberg into one of his eigenstates and the professor is no longer with us. Darryl, however, is still evolving according to the time and space dependent LIFE operator. He is in a superposition of states and, just like in quantum mechanics, we cannot predict what will happen to him. We can only estimate some probabilities. There is a very high probability that Darryl, thanks to the contributions of Professor Grinchberg, will be accepted at a good university and will have a successful career.

Crime and Electromagnetism

The many-world interpretation of quantum mechanics and multiverse theories are some of the weird concepts floating around in modern physics, things that most of us do not really understand. We can safely say that these ideas are at the boundary of science and philosophy. In any case, for the purpose of this story, we will assume that parallel worlds do exist. The following fictional account takes place in one such parallel world. Accordingly, any similarity to entities and events in the world in which we live should be considered purely coincidental.

*****

El Rescuador is a small country in the central part of a Western continent.

It is considered to be a poor country, with a mostly agrarian economy, and a high level of unemployment, especially among young people. As a consequence, a number of young men turn to crime, and join gangs that profit by extortion and drug sales. Not surprisingly, the gangs fight over control of certain areas and they have developed rituals, symbols, and hand gestures specific to their membership. The level of violence, especially in the capital city of San Rescuador, is very high.

Another option for young men is emigration to the UM (short for United Mansions), a larger and more prosperous country to the North. This route is not easy and many are turned back. Some are put off by discouraging stories about the realities of sneaking in to live in the UM, including experiences of racism and police brutality that are often directed toward people with darker skin. In spite of this, many young people attempt the long and perilous route North.

Fernando Arteaga was one young Rescuadorean who did not need to think about emigrating. He was about twenty years old, came from a middle-class family and was studying engineering at the local university. He had never been in trouble with the law, never did drugs, and was kind of a nerd. At a younger age he had been enrolled in a sort of academy run by a religious organization, but he had been expelled from the school after he complained about some attempts at sexual abuse from a priest who was supposed to teach elements of biology. It had been a minor scandal and had left in him some scars and hostility towards the church, as documented by some articles that Fernando later wrote in a student newspaper.

Typically, gang violence was usually limited to particular areas and the gangs would leave people like Fernando alone. One day Fernando was sitting on a bench in a city park, reading a text book while preparing for an exam. Suddenly a shot rang out and a bullet barely missed Fernando's head. Dogs barked, people took cover, and it took some time before things got back to normal (as normal, that is, as they could be in El Rescuador). A policeman appeared and began to take testimony. A priest who had been sitting on a nearby bench reading his breviary testified that the young man with the book had been making some gestures with his hands, sticking out three fingers, just before the shot rang out. "So, you are a member of the Bichos Locos gang," inquired the policeman. "What?" Fernando did not understand.

Well, the three-finger gesture was the hand signal of the Bichos Locos gang. They used it to recognize their members and occasionally to

challenge adversaries. As everybody knew (or should have known), there was presently a turf war going on between the Bichos Locos and the Maniacos gang.

A page in the book that Fernando had been reading showed the rule of the right hand (*regla de la mano derecha)*, a mnemonic used to visualize the effect of the motion (*movimiento*) in the direction of the thumb (*pulgar*) of a conductor, like a wire, lined up in the direction of the middle finger (*dedo medio*), while lying in a magnetic field (*campo*) oriented as the index finger (*dedo indice*). The result is an electromotive force and eventually a current (*corriente*), if the circuit is closed, in the direction of the middle finger.

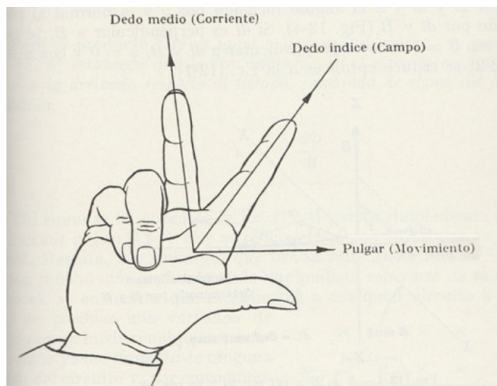

FIG. 12-3.—Regla de la mano derecha.

A circuit closed in Fernando's brain and now he realized why he had been shot at. While studying his book, he must unwittingly have practiced the rule, and the sign must have been misinterpreted by a member of the rival Maniacos gang who had taken him for a Bicho Loco.

"You better talk and tell us what you know," said the policeman. Fernando did not know anything, but he could tell that the policeman and the other witnesses, especially the priest, would not believe him.

One who believed him was a young woman by the name of Samantha, whom Fernando had befriended. Samantha had a different background from Fernando and occasionally worked in a strip joint, but the two were comfortable together. Because of her exposure, Samantha had access to rumors going on in the underworld. So, she warned Fernando.

"Look, the police do not believe you, they think you are hiding something. The Maniacos feel that they have been made fun of and want revenge. And to the Bichos Locos you have become kind of a hero and they will pressure

you to become a real member of their gang. And the church is not going to help you".

So, Fernando felt trapped and faced by multiple dangers. At the same time, he got wind that a foreign company was recruiting laborers to do construction work in a faraway land. Fernando wanted to get away. He learned that in the UAE (United Arid Enclaves), a small country flush with oil money and where the construction jobs could be found, the three-finger gesture was actually a symbol of the country. "I could be safe there," he thought. "Heck, they even have a statue celebrating the rule of the right hand."

So, Fernando signed up and was flown to the UAE. He worked there for three years, during which he learned many trades. However, he struggled with the food, the alcohol prohibition, and covering up of women; all things that, in spite of what was ostensibly allowed for tourists, still represented the cultural backbone of the host country. These proved too much for him, and he said goodbye to the United Arid Enclaves and went back to El Rescuador. There, he learned from Samantha's sister that his former girlfriend had gotten involved with someone from the UM, who had taken her there. And she was still living in that country now, after ending that relationship.

Fernando traveled to the border where he asked for asylum, claiming that the police, the gangs, and the church were after him. He was granted temporary status and went to live with Samantha.

Eventually he was granted a work permit and residence status. He started a business, went back to school, and eventually married Samantha. Life in the UM was not so bad after all. Luckily, Fernando never encountered racism or experienced police brutality. In time, he even managed to acquire a little mansion for himself and his family.

Inquisition

It was almost five o'clock in the morning when Scott Berry arrived to open the fitness center in Westwood, a wealthy residential and commercial district of Los Angeles. The center opened so early because members of the energetic population of Westwood (such as financial advisors in search of clients, managers of investment firms, real estate agents, aspiring entertainers, you name them) would get up early and "work out," as they put it, before their real work, or whatever it was, began. Scott had been working at the fitness center for several years. As soon as he turned the lights on, he realized that something was wrong. With utter disbelief, he noticed that several pieces of the exercise equipment were not there anymore. Actually, it looked like they had never been there. Soon afterwards, some other employees arrived. There were frantic calls to managers, and eventually to the police (the famous Los Angeles Police Department, or LAPD, featured on TV serials).

The first thing was, all the equipment that was missing did not need to be connected to a power source. Expensive items such as exercise bicycles connected to fancy computer displays and calories counters had not been touched. Instead, contraptions designed to stretch any muscle in the human body - bizarre combinations of pulleys, cables, and heavy wheels - had disappeared. Second, and this was more upsetting, there was no trace that such things had ever been there. The concrete floor where those monstrosities had once been was perfectly smooth and showed no sign of the bolts which had kept the equipment tied down.

In spite of all the resources and efforts put in by the LAPD, the thieves, or whatever, were never found. For a while, conspiracy theories, reaching to the highest level of the Federal Government, floated around, but a

convincing explanation was never found, and the matter was eventually forgotten.

*****

It was the year 1636, in Salamanca, Spain. Cardinal Tomás de Beltran y Altamira, the Grand Inquisitor, had been called there to provide his opinion on a case that risked creating an embarrassment to the crown. A local nobleman, Count Almaviva, had been accused of participating in and actually promoting the activity of a group accused of heresy. Because of the position of the accused, the local inquisition prosecutors were weary of proceeding against him for fear of creating friction between the church and the civilian authorities. Cardinal Tomás was known for his strictness and incorruptibility, and was a great admirer of his famous predecessor Torquemada. After examining the acts of the trial, he determined that Count Almaviva was in fact guilty of extreme heresy, and sentenced the poor guy to be burned at the stake.

Tomás de Torquemada

One thing that was not known about Cardinal Tomás de Beltran y Altamira, however, was that he was going through a state of mental introspection that had filled him with anguish and anxiety. He was of course informed about Galileo's trial and his discoveries, and was wondering what would happen to religion and doctrine if the rate of scientific advancement were to accelerate dramatically. It was at about this time that Mephistopheles, who had been defeated in his attempt to compromise Dr. Faust, approached him.

"Your Eminence," said Mephistopheles, "I know that you are concerned about the advances of science. As a matter of fact, I share your concerns, although from a different perspective. But I would like to offer you a deal. I can transplant you to the year 2000 (after Christ, just to make sure). After

one week you can decide if you want to stay there, in which case you will give me your soul at the end of your life. Or, at the end of the week, you may decide to come back, in which case you can bring something of your choice out of that century."

"I will think about it," said Cardinal Tomás, "and I will get back to you." After many sleepless nights during which he considered the advantages of knowing what four centuries would do to the world, he decided to accept Mephistopheles' offer. He told his staff that he would be in retreat for a week, meditating and doing penance in total isolation. And then he moved on.

*****

It was now the year 2000 and Cardinal Tomás was in Westwood, an affluent neighborhood of Los Angeles, California. He was going by the name of Tom. Thanks to Mephistopheles' influence, he had quickly adapted to the new environment. He spoke English like a native Californian and, just in case, had been provided with documents that would prevent him from being deported as an illegal, pardon, undocumented alien. He actually liked the culture in which he was now living, and in the brief time that he had at his disposal he tried practically everything from Mexican restaurants to nightclubs. One thing that captured him most was a visit to UCLA (University of California, Los Angeles). There, he listened to a lecture on quantum mechanics, and was so taken by the subject that for the first time he considered staying, even though that meant losing his soul. He was such a fast learner that he pictured himself getting a quick PhD and eventually teaching and doing research at UCLA.

While he was so conflicted regarding his options, Cardinal Tomás or Tom, as you please, decided to decompress. A good way would be to sign up for physical exercise, so he went to a fitness center. And there is where he made his decision.

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Back to Spain and to the 1600s. Cardinal Tomás de Beltran y Altamira had the torture room at the main Inquisition center upgraded and outfitted with the exercise equipment from the Westwood fitness center. Not many people questioned where those shiny items came from. The few that did were told that the Lord moves in mysterious ways, or, as they say in Italy, *le vie del Signore sono infinite*. No one objected to that. What we know is that after

the upgrade, according to the statistics maintained by the Inquisition, the number of confessions from heretics in a semester increased by 347% over the previous period.

When Cardinal Tomás de Beltran y Altamira died in old age his beautiful soul went to Heaven and Mephistopheles was defeated again.

Chicken Rotisserie

Professor Gianluca Baragatti wanted to cook a chicken on the rotisserie. However, the short meat-holding forks that came with the spit in his barbecue grill had only two prongs (rather than four) and did not work well in holding up a heavy chicken. Gianluca remembered that he had two long items that he had carried over from Brazil. These things (spits? forks?) were perfect for holding large chunks of meat, such as a nice picanha cut into three pieces. Gianluca had carried over the things from Brazil during the time when nobody questioned what you were taking aboard an aircraft. Those were the good old days when nobody would think that your intentions were to pierce a stewardess, at least not with sharp steel objects. Unfortunately, those days are gone.

Gianluca thought that, with some adjustment, one of the Brazilian items could be used to hold the chicken and turn it on the grill. He searched his garage for leftover hardware items, of which there were many, even though his wife Berenice periodically cleaned the shelves. He eventually found some junk pieces that, with a little modification, would do the trick: a piece of threaded rod, an old drawer handle, nuts and bolts as needed. After he managed to couple the contraption to the rotisserie motor, he wanted to make sure that the system would work with a weight comparable to that of the chicken which was about five pounds. So, he took some books, mostly

physics books, and gradually secured them to the spit that would eventually hold the chicken, using heavy rubber bands, until he reached the desired weight. You get the idea. At room temperature the system operated very smoothly, which gave Professor Baragatti a high enough confidence level that it would also keep working at 500 ^{0}F or so. While he was doing these experiments, Berenice went by and commented that he had too much time on his hands, probably an understatement.

When the time came the system worked well, and the chicken was cooked properly. Gianluca Baragatti, Berenice, and their daughter Vanessa had a good lunch, which included Italian wine and Brazilian tropical drinks, not necessarily in that order. After lunch Gianluca relaxed on the couch and started thinking about the angular momentum of the rotating chicken. "Let us see," he thought, "with an angular velocity of the order of 1 turn per second and a moment of inertia of the order of a kilogram, the angular momentum must be of the order of 10^{3} erg sec. And since the Planck constant is of the order of 10^{-27} erg sec, it follows that the chicken had an angular momentum about thirty orders of magnitude larger than that of each one of its electron, proton, and neutron constituents. Wow! That really makes you realize how small atoms are."

While Gianluca was deeply absorbed in these considerations, he suddenly remembered that he had not turned off the gas on the grill. He rushed outside. To his great disappointment and dismay, he saw that his books were burning. Not only that, but the yard was now full of people, all angry

at him. At first all of his neighbors were there, which would have made some sense, but the crowd kept increasing. Soon it included famous scientists and statesmen from the past.

“He has burned all the physics books!” yelled someone.

“He has burned my *Dialogo dei Massimi Sistemi*!” echoed Galileo Galilei.

“And my *Principia* too, both volumes!” joined in Isaac Newton.

“The son of a bitch has burned the *Bible*!” cried the Pope.

“He has burned the Constitution of the United States!” shouted Abraham Lincoln.

The noise increased, the crowd moved menacingly forward, and Gianluca had no way to escape. There were cries of “Let us burn him.” A pole was hastily erected in the yard and a pile of dried wood was amassed under it.

At this point Professor Baragatti woke up, kind of shaken, and realized that the stereo was on and Luciano Pavarotti was singing the most famous aria from Verdi’s opera *Il Trovatore*.

Di quella pira l' orrendo foco
tutte le fibre m' arse, avvampò!...
Empi spegnetela, od io fra poco
col sangue vostro la spegnerò

> The flames of that terrible pyre
> inflamed and consumed all my being!...
> Pitiless men, put it out, or I will shortly
> do it with your own blood...

“Next time you should make a smaller chicken,” said Berenice.

“And you should be more careful with the tropical drinks!” added Vanessa.

The Department of Metaphorics

It was the beginning of the academic year at the University of K and the dean of the physics department was making a speech: “In the year 1900 Lord Kelvin said that there was nothing new to be discovered in physics. All that remained to do, he said, was more and more precise measurements. We all know how wrong that statement turned out to be. However, I will

take the risk of saying that the same statement runs true today. It has been at least two decades, and in our school, as well as in other universities and national laboratories, no new significant discoveries have been made in the physics field. At the same time the general public has become more and more interested in learning about quantum theory. This interest has been a godsend for some of our professors who, in this era of diminishing research funding, have published many books in the *For Idiots* category. Now you know that when trying to explain physics concepts, especially quantum related concepts, to the uninitiated, nothing is more powerful than the metaphor. Since I predict that the demand for explanatory low-level literature will increase, I propose that we aggressively expand our activity in this field by creating a Department of Metaphorics. I have asked Professor X to chair a committee and eventually lead the new department."

The idea was received with enthusiasm and the committee set out to work. A few months after the original proposal the Department of Metaphorics was functional and Professor K had succeeded in receiving grants and even contracts from private industry and foundations.

The charter of the new department had the following objectives:

1) Revise old metaphors by using more modern settings and language.

2) Develop new metaphors to illustrate physical concepts.

3) Promote the usage of metaphors at all levels in schools and for the public at large.

In the initial phase, work concentrated mostly on the first category. The last significant discovery had been the observation of the Higgs boson, a heavy particle, the quantum of a field supposedly responsible for the creation of mass, occasionally misnamed as the *God particle*. To illustrate this phenomenon, a British scientist had come up with the following metaphor. Imagine that Margaret Thatcher (she was very popular in 1993) moves across a crowded party. As she moves around the room people congregate and, in a sense, she has more mass than everyone else; once she is moving, she is hard to stop, and once she has stopped she is hard to get moving again. That, in essence, is the Higgs mechanism.

Well, that was ok in the nineties, but now practically no one in the new generations knew who Margaret Thatcher was, so the metaphor was updated using the name of the governor of New Jersey, who was presently a candidate in the next presidential election. In addition to name

recognition, selecting the governor had the advantage of a more immediate connection with the concept of mass.

Another metaphor that was revamped was the one on alpha radioactivity (barrier penetration, also known by the alternative name of quantum tunneling). One can visualize alpha particles held in the nucleus by a force, which generates a barrier that traps the particles. This is like a prison. According to classical mechanics, the particles should never get out; according to prison regulations, the convicts should never escape. However, in reality some prisoners manage to escape and according to quantum mechanics there is a finite probability for tunneling, no matter how high or massive the barrier is. The analogy, or metaphor, was refined by identifying Guantanamo as the prison, a site that in spite of many attempts by successive presidents had never been closed.

Professor X was very successful in expanding the department. Graduate students were working on dissertations, papers were published in academic journals, and new topical conferences were organized. At one point a wing of the department building was expanded and a dedicated museum was set up in it. The history and mission of the museum deserves a separate story.

Everything was going great until disaster developed. Superconductivity is a kind of macroscopic quantum phenomenon. At normal temperatures, electrons (which are single particles with identical characteristics), can be egged on by electric voltages and make their way with some difficulty in everyday conductors. The resistance they encounter is useful in many ways, such as warming rooms and cooking eggs. However, at very low temperatures and in certain materials, these electrons join two by two in what are known as Cooper pairs. When this happens, they change their nature from fermions to bosons (admittedly this is complicated), but the result is that due to their new nature they can all be in one big collective state, which can move together with no resistance, therefore superconductivity. You have to know that this theory had been and was still opposed by religious groups who said that electrons could only form unions with different particles, such as protons.

As a subject for his PhD thesis, G was given the task of developing a metaphor for superconductivity. He began by comparing electrons to people who are gay. The diminished role of conservatism in society was the analogy to the reduction in temperature, which allowed the formation of unions (such as the Cooper pairs), between two individuals with similar characteristics. This would result, according to G, in a large gay pride

parade flowing through the city, somewhat similar to the large superconducting current.

The above ideas were not fully developed, and G never managed to complete his thesis. Information about this work was leaked and was shared to members of the Department of Political Correctness in the same university. This generated a tremendous uproar and a conflict started between the two departments. Initially it was a cold war, but with the egos of the professors involved, escalation ensued. The two departments developed weapons of mass destruction and in the short war that followed the entire university was destroyed.

The Museum of the Department of Metaphorics

At the height of its power the Department of Metaphorics decided to create a museum that would preserve the most cherished artifacts that had been used to illustrate or even to inspire principles and discoveries in physics, especially quantum mechanics. After several years the museum had grown to possess a large number of valuable pieces, in great measure due to the generosity of alumni and philanthropists. It was known as MOMS, for Museum Of Metaphorical Science.

The most celebrated piece, which was shown under a thick protective glass with several layers of security, was the hide of the original Schröedinger cat. It was common knowledge that the cat, after living for several years in a state of superposition, living and dead, had encountered a perturbation that had caused its wave function to collapse into the dead state. The most famous taxidermist of the world, who had worked for the family of a sequence of North Koreans dictators, had been charged with the preservation for posterity of the looks of the Schröedinger cat.

Another celebrated piece was Newton's apple, which, so the story goes, was instrumental in the introduction of gravity. The museum had actually bought the apple from a creationist museum in Texas where it had been displayed as the original apple used by the Snake to entice Eve. It was not surprising that an apple like that would not sit still and would eventually end up in Newton's hands. It was rumored that the apple had a lot of experience, and had even spent time in Cleopatra's bedroom. At the time of the purchase the creationist museum was short of money, mostly because of a decline in religious fervor, and so it had accepted the offer by MOMS.

To sweeten the deal the curator of MOMS had included a pin which had actually been used by Saint Thomas Aquinas in his discussions on the number of angels that could be dancing on the head of the pin. MOMS was always on the lookout for exceptional pieces, also for possible exchanges, and it employed a number of agents who were scouting the world for discoveries. It was one of these agents who had found the Thomas Aquinas pin in a flea market in Berlin.

You may ask, and some people in fact asked, *how do you know that these artifacts are in fact authentic*? To this, the museum representatives invariably said that they had documents to prove it. They would also point to the fact that all the churches in the neighborhood had bones and fragments of bones from untold saints and martyrs, and the best proof of their authenticity was the devotion by huge crowds of the faithful. “At least,” they would say, “we do not claim that these pieces perform miracles.”

Another famous object was a minuscule fragment of paper (4 square millimeters at most) with a number 2 written on it. Well, this was actually a very tiny portion of a page on which Einstein had, for the first time, written his famous equation $E=mc^2$. The fragment had been found in a dump in Bern, where Einstein was working at the time of his discoveries. Attempts to find the other letters had failed, and the museum was not interested in later original writings by Einstein, although they were quite valuable, which contained the entire formula.

The museum was also proud to have the original cake used by J.J. Thomson in his formulation of the plum pudding atom model, in which the pudding represented the positive charge and the candied fruits the negative electrons. The pudding was exceptionally stable, and did not show signs of decay. Some visitors who had made return visits to the museum had noticed some minor change in the position of the *electrons*, and the museum representatives explained this with the fluctuations due to the uncertainty principle, something that Thomson obviously did not know.

The museum had many other valuable pieces, and was in the process of acquiring many more, but unfortunately it was destroyed in the war that erupted between the Department of Metaphorics and the Department of Political Correctness. It is rumored that the curator managed to escape with some of the most valuable pieces to a large South American country, and there is hope that the uncorruptible values so cherished in that country will contribute to the preservation of those treasures.

Pâté de Cognac and Wine

A widespread pandemic had made life very boring for Professor Gianluca Baragatti and his wife Berenice. Before the arrival of the virus they used to travel, especially outside of the United States, in part to escape its recently toxic political atmosphere. But with the many restrictions imposed by the state, their friends, and themselves, most outings including travel, meetings, and relaxing in a café or restaurant were no fun anymore. Luckily their daughter Vanessa had joined them and was working from their home. In the rare moments when she was not in constant communication with her office in Seattle and the rest of the world, she provided bursts of unexpected fun and good-natured humor. But still, interaction with the outside world was limited and, frankly, mostly unappealing.

Thus, it was a welcome change when the Baragatti's other daughter, Belinda, announced that she would take a week off from her work in Dallas and come visit. Because of the pandemic and other events, it had been a while since she had seen her parents, and Berenice was ecstatic. Now, you have to know that whenever one of his daughters comes home after a period of absence, Professor Baragatti refers to the event as the return of the prodigal daughter, even though, unlike in the biblical parable, the offspring is not in dire need of financial assistance. It is just an occasion for celebration.

According to the Bible (Luke 15:11–32), *the father said to his servants, 'Quick! Bring the fattened calf and kill it. Let's have a feast and celebrate.'* Professor Baragatti could not do that for two reasons. First, he did not have any servants. And, second, he did not have a fattened calf. So, as an alternative, he made a calf liver pâté. Berenice had a preference for chicken liver, and, after some environmental impact assessment, the essential ingredients used in the recipe were as follows:

- Calf liver, one pound (454 grams)
- Chicken liver, two pounds (908 grams)
- Cognac (a cheap brandy, not VSOP), one cup (236 cubic centimeters)
- Other ingredients, like aromatic herbs, and so on, as recommended in many recipes on the internet
- And, of course, plenty of gelatin

The pâté was considered successful and was served multiple times as an appetizer during the celebrations for the return of the prodigal daughter. But Professor Baragatti wondered if he should have put a warning for anyone preparing to taste his creation. From the volume of the pâté and the amount of 80 proof brandy in it, he figured that the alcohol content was about 12%, or close to that of a light wine. The California DMV (Department of Motor Vehicles) is very strict when it comes to DUI (Driving Under the Influence) and publishes a *sexist* chart giving the blood alcohol content as a function of drinks (properly defined), personal weight, and *gender*. Gianluca Baragatti did not go as far as creating a similar chart for his pâté (this would have been weird, even by his standards), but he could tell you that, per the chart, a light woman (say 100 pounds) eating a one-inch slice of his pâté would come dangerously close to the blood alcohol limit that may get one into trouble with the police. Accordingly, he served smaller portions. Nobody got drunk, although everybody admitted that he or she could taste the brandy.

The pâté was initially served with a strong red wine (Merlot 2017, from Rutherford Ranch, 14.5%), which got Professor Baragatti thinking, and Berenice wondering, about what useless thing he would do next. Gianluca was of course thinking of Ernest Rutherford, who discovered the atomic nucleus in 1911. And his thinking was: are there other wines or alcohol products that are named after famous physicists? Amazingly enough, there are plenty.

Starting with classical physics, we find wines named Newton, Maxwell, then Hamilton and Chateau Lagrange (the last two named for the Hamiltonian and Lagrangian density encountered in quantum mechanics). Moving to modern physics we find more wines: Soleil de Planck, named for Max Planck, the one of the Planck's constant (who else?). On a higher level (alcohol, of course) we find Heisenberg Vodka and Schrödingers Katzen gin. And back to wine we have Sancti Pauli (the Pauli principle), Domaine de Broglie (wave mechanics), Jordan (named after Pascual Jordan who could have gotten a Nobel prize but did not, because he was a member of the Nazi party), and last but not least, le Dirac. There is also a beer named after J. Robert Oppenheimer, who went from theoretical physicist to manager of the Manhattan Project.

After finding all these correlations Professor Baragatti started developing a theory, according to which for each major contributor to physics there is a wine or alcohol product named after him. So, what about Fermi? Fermi associated his name to so many things: the Fermi surface, the Fermi age, Fermi statistics. Well, there is a company in France called Fermivin, which produces all kinds of yeasts used in the making of wine. And what about Einstein? Well, in Oakville, a Canadian town near Lake Ontario, there is a place called Ein Stein; according to their website they will make and bottle wine for you, starting from concentrates.

The theory has been criticized because of some blatant inconsistencies. For example, why is there no wine or alcohol product named after someone as important as Niels Bohr? The response from Professor Baragatti is that many theories in physics have predicted the existence of particles that were only found later after spending billions of dollars on accelerators and the like.

“Give me a couple of million dollars and, by golly, I will find you a Bohr wine,” he said.

But a bigger problem loomed on the horizon. Research could not find any wines or alcohol products named after Madame Curie, who discovered Radium, or Lise Meitner, who actually discovered fission. In the current day and age this was totally unacceptable. The women in the Baragatti household, who were in the majority and were not willing to wait for future discoveries, declared the theory to be irredeemably sexist, and banned it to the world of fiction, where it is likely to stay.

APPENDIX

Quantum Mechanics and Gastronomy: Potatoes a la Brillouin

Leon Brillouin
1889 - 1969

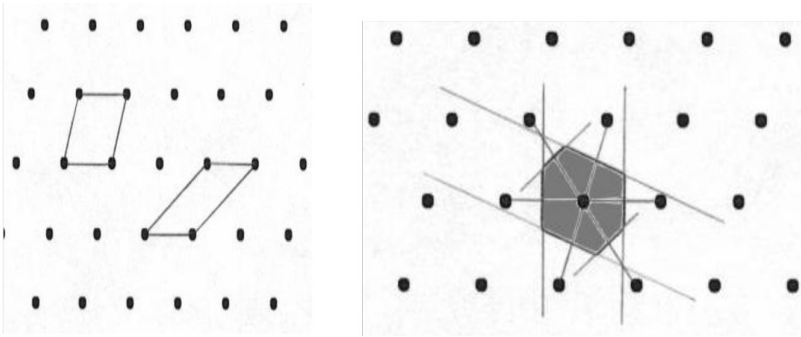
Important figures from the fields of music, literature, and politics have associated their names with culinary specialties. That is why we have tournedos a la Rossini, Chateaubriands, oysters Rockefeller, eggs a la Bismarck, and many more. To our knowledge, no illustrious name from quantum mechanics has been associated with any dish. This is not fair, so the purpose of this effort is to correct the above inequity and introduce a recipe with a quantum mechanics connection. The connection is purely formal, based on the shape into which the main ingredient is cut.

The new recipe is named for the French physicist Leon Brillouin, whose name is also associated with the WKB (Wentzel-Kramers-Brillouin) approximation, a method for solving the wave equation in quantum mechanics.

Solid State Physics and Brillouin Zones

Crystals are periodic structures, therefore they are based on the concept of a lattice. A lattice is characterized by a unit cell, which repeats itself by translational symmetry. One can choose the unit cell in an infinite number of modes, as shown in Fig 1a for a two-dimensional lattice. In some cases one prefers to use a cell like the one shown in Fig 1b, which is more

symmetrical and is known as the Wigner-Seitz cell.

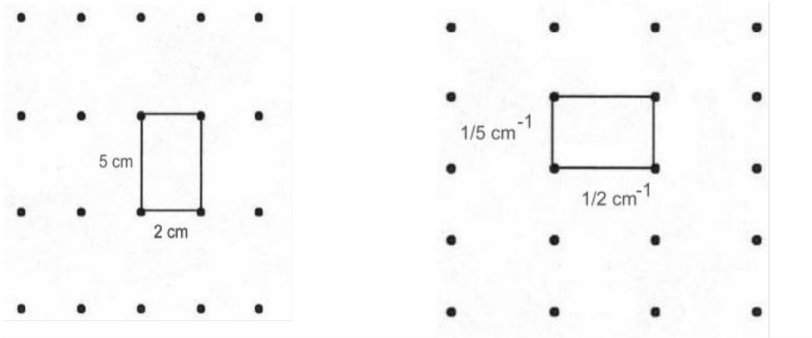


(a) (b)

Figure 1: Generic unit cells (a) and Wigner-Seitz cell (b)

The application of quantum mechanics to crystals results in waves propagating through the crystal. Examples of these waves are phonons (lattice vibrations) and electron wave-functions in metals. The description of waves (for example, x-rays) in a crystal is enormously facilitated by the introduction of a simple artifice, called the reciprocal lattice. Figure 2 shows the transition from a direct lattice to a reciprocal lattice in the simple case of a two-dimensional rectangular lattice.

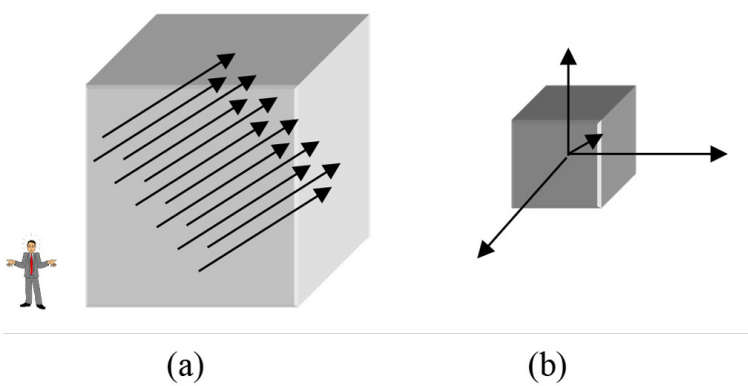
With some imagination, the process is somewhat similar to taking a unit cell and turning it over like a sock. At any rate, we now have a new lattice, the reciprocal lattice, in which the distances are measured in cm^{-1} instead of in cm. Multiplying a quantity expressed in cm^{-1} by the Planck constant h, one obtains a momentum, so the new lattice is perfect for representing momenta. In fact, reciprocal space is essentially equivalent to momentum space. Within this new lattice we then take a Wigner-Seitz cell, and this is universally known as a Brillouin zone.



(a) (b)

Figure 2: Example of direct lattice (a) and reciprocal lattice (b)

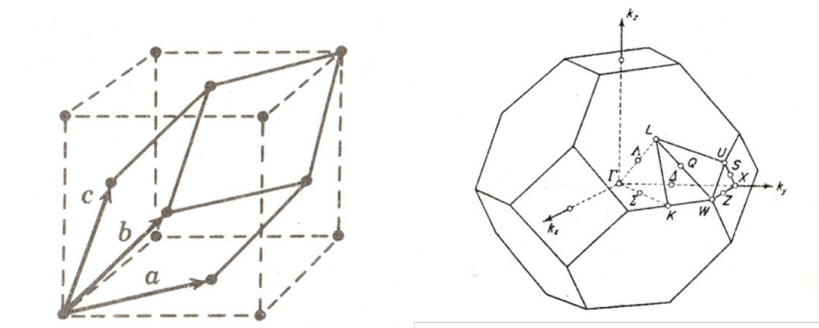
The Brillouin zone is very important in solid state physics because many quantum properties can usually be described within this zone: for example, the lattice vibrations, or the band structure of the electrons in a metal. You can choose your representation; in direct space you can picture a very large block of jelly in which a wave propagates, whereas in reciprocal space you can picture a vector k within the Brillouin zone. Figure 3 tries to convey an idea of this situation. The block in (a) is very large, practically infinite in terms of number of atoms, and the attempt at visualization is not very successful. The representation in (b) with a single vector is much simpler and more useful. In any case, both pictures are representations of a free particle. Incidentally, this way of forming a mental picture is much more general. If the block of jelly represents an appropriate field, the particles in it can be photons, electrons, mesons, etc.



(a) (b)

One of the most common lattices is the face-centered cubic (fcc) lattice. Many simple substances, for example aluminum and copper, are fcc. The

Brillouin zone for the fcc lattice has an interesting shape. Figures 4 a and b show a possible unit cell for the fcc lattice and its corresponding Brillouin zone. The Greek letters correspond to group theoretical notations having to do with the symmetry of some elements (lines, planes) within the Brillouin zone.



(a) (b)

Figure 4: Face centered cubic generic unit cell (a) and Brillouin zone (b)

We now forget about the deep meaning of the Brillouin zone in solid state physics, and concentrate on its shape (from now on, when we say Brillouin zone or simply BZ, we mean Brillouin zone for the fcc lattice). How do we build a BZ? We start from a cube and slice each of the eight corners perpendicularly to the diagonal of the cube passing through the corner. This process is illustrated in Figure 5, where one progressively slices more and more of the corners. When you are exactly right, the triangular faces turn to hexagons and you have a BZ.

Figure 5: Different shapes obtained by cutting corners of the cube

Recipe

10 lbs. large Russet potatoes (makes about 16-18 BZ)

Bacon slices

Cayenne pepper

Salt

Olive oil

Chives

Peel the potatoes, then wash and dry them. Cut the potatoes in fcc Brillouin zone shapes. Each potato must first be cut into a cube. Then you cut each corner perpendicular to the (111) direction. Try to visualize the origin as the center of the cube, then cut perpendicularly to the 111 direction bisecting the vector from the center to each corner. This is not easy but is worth trying. If you do not cut yourself first, you will probably end up with a shape that is quite different from the Brillouin zone.

A better way consists of building a simple little jig, following the design shown in Figure 6. The dimensions indicated correspond to a cube whose side is 50 mm, which seems to work well with large size potatoes.

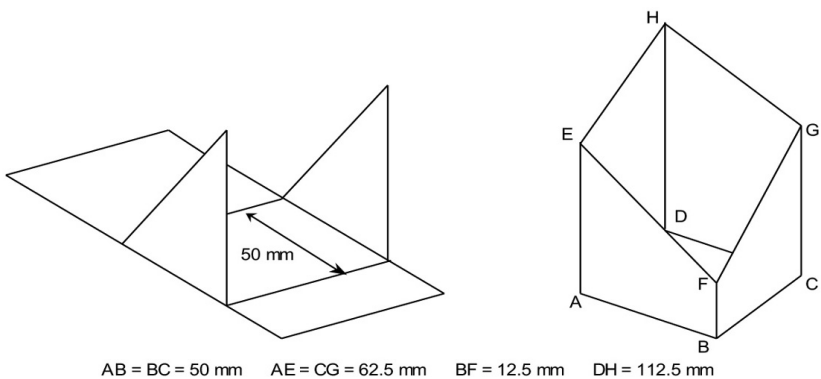


Figure 6: Dimensions for jig

The first piece is used to make the cube, by following the guides to make cuts perpendicular to the base. There are two marks on the base, spaced 50 mm apart. Hold the potato steady and, after the first cut, carefully align the cut side with the mark. The second piece of the jig is used to cut the corners of the cube. You must slide the cube 8 times into this part of the jig and make the diagonal cut.

Figure 7 shows an implementation of the jig using thin plywood. Since the plywood has some thickness, the dimension indicated in Figure 6 should be measured on the inside surface of part b of the jig. In other words, you should account for the thickness of the material forming the jig. Another trick is to glue only three of the four sides of part b (leave the 12.5 mm side unfastened). This makes it very easy to slide the cube (or what is left of it) into the jig and also allows one to exert a slight pressure with the fingers, thus holding the potato steady during the cut. Quite obviously, a better (industrial!) model could be made by forming a metal sheet.

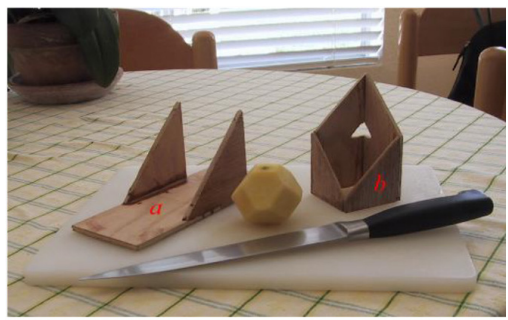


Figure 7: Simple jig

Precook the potatoes for about 10 minutes in slowly simmering water. Make sure not to overcook. Cool the potatoes and arrange them in a casserole dish, in such a way as to illustrate that the BZ shape permits all units to be tightly packed. Figure 8 shows two possible arrangements, one showing the cubic symmetry (axis 001 vertical) and one showing the 120 degree symmetry of the cubic lattice (axis 111 vertical).

Put small slices of bacon (about 5 cm^2 each) between adjacent faces of the potatoes. This leaves a little spacing and takes care of irregularities. Pour some olive oil over, and sprinkle with salt and Cayenne pepper. If the potatoes tend to slide, use wooden toothpicks to hold the structure together.

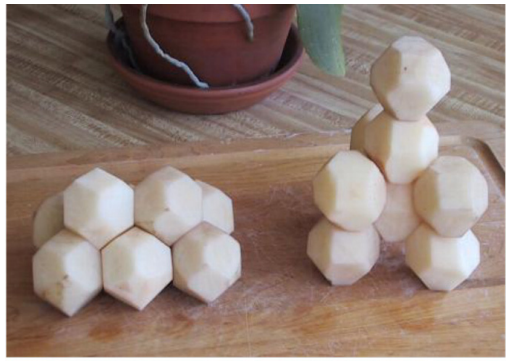


Figure 8: Stacks of Brillouin zones

Bake at 450 degree Kelvin (about 350 deg F) for about one hour. Sprinkle with chives and serve hot with a good roast, beef, lamb, or pork.

Figure 9 shows the final result. The young lady is thinking deeply about the meaning of reciprocal space.

As a final comment, we note that the volume of the BZ is exactly 50% of the volume of the cube. Since large potatoes are generally oblong, each cube is about 50% of the volume of an individual potato. This means that you get about 25% BZs from a certain amount of potatoes. Starting from 10 lbs. of such potatoes you get about 2.5 lbs. of Brillouin zones.

The leftover scrap can be used for other purposes, such as making gnocchi (highly recommended) or mashed potatoes.

Figure 9: Voilà, potatoes a la Brillouin